

FCC PART 15C TEST REPORT FOR CERTIFICATION

On Behalf of

SHARP Corporation

Electronic paper display

EP-C251

FCC ID: APYBSC0005

SHARP

Prepared for : SHARP Corporation

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Report Number : ACS-F23209

Date of Test : Oct.18~Nov.04, 2023

Date of Report : Nov.28, 2023

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TEST REPORT

Applicant : SHARP Corporation
 Manufacturer : SHARP Corporation
 Product : Electronic paper display
 FCC ID : APYBSC0005
 (A) Model No. : EP-C251
 (B) Brand : SHARP
 (C) Test Voltage : AC 120V/60Hz

Tested for comply with:

FCC CFR47 Part 15 Subpart C
 Test procedure used: ANSI C63.10: 2020;
 KDB 558074 D01v05r02

The device described above is tested by Audix Technology (Shenzhen) Co., Ltd. to confirm comply with all the FCC Part 15 Subpart C requirements. The test results are contained in this test report and Audix Technology (Shenzhen) Co., Ltd. is assumed full responsibility for the accuracy and completeness of these tests. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements. This report contains data that are not covered by the NVLAP accreditation.

This Report is made under FCC Part 2.1074. No modifications were required during testing to bring this product into compliance.

This report applies to single evaluation of one sample of above mentioned product and shall not be reproduced in part without written approval of Audix Technology (Shenzhen) Co., Ltd..

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

Date of Test : Oct.18~Nov.04, 2023 Report of date: Nov.28, 2023

Prepared by : Mia Zhao Reviewed by : Thomas Chen
 Mia Zhao / Assistant Thomas Chen / Assistant Manager



1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT has been tested according to the applicable standards as referenced below.

EMISSION		
Description of Test Item	Standard	Results
Power Line Conducted Emission Test	FCC Part 15: 15.207 ANSI C63.10 :2020	PASS
Radiated Emission Test	FCC Part 15: 15.209 FCC Part 15: 15.205 FCC Part 15: 15.247(d) ANSI C63.10 : 2020	PASS
Conducted Spurious Emissions	FCC Part 15: 15.247(d) ANSI C63.10 : 2020	PASS
Carrier Frequency Separation Test	FCC Part 15: 15.247(a)(1) ANSI C63.10 : 2020	N/A
6dB Bandwidth Test	FCC Part 15: 15.247(a)(2) ANSI C63.10 : 2020	PASS
Maximum Peak Output Power Test	FCC Part 15: 15.247(b)(1) ANSI C63.10 : 2020	PASS
Band Edge Compliance Test	FCC Part 15: 15.247(d) ANSI C63.10 : 2020	PASS
Power Spectral Density Test	FCC Part 15: 15.247(e) ANSI C63.10 :2020	PASS
Antenna requirement	FCC Part 15: 15.203	PASS

N/A is an abbreviation for Not Applicable.

Note: Measurement uncertainty affection to the result is not considered, the EUT is technically compliant with standard requirements.

2. GENERAL INFORMATION

2.1. Description of Equipment Under Test

Applicant	SHARP Corporation
Applicant Address	1 Takumi-cho, Sakai-ku Sakai City Osaka 590-8522 Japan
Manufacturer	SHARP Corporation
Manufacturer Address	1 Takumi-cho, Sakai-ku Sakai City Osaka 590-8522 Japan
Factory	TPV Electronics (Fujian)Co.,Ltd.
Factory Address	Rongqiao Economic and Technological Development Zone, Fuqing City, Fujian Province
Product	Electronic paper display
Model No.	EP-C251
FCC ID	APYBSC0005
Brand	SHARP
Power Adapter	Manufacturer: DELTA ELECTRONICS, INC. M/N:ADP-100XB B Input: AC 100-240V 2.0A 50-60Hz Output: 5.0V $\overline{\text{---}}$ 3A, 15.0W / 9.0V $\overline{\text{---}}$ 3A 12.0V $\overline{\text{---}}$ 3A / 15.0V $\overline{\text{---}}$ 3A 20.0V $\overline{\text{---}}$ 5.0A, 100.0W DC Cable: Unshielded, Undetachable, 1.5m
Sample Type	Prototype production
Date of Receipt	Jun.21, 2023
Date of Test	Oct.18~Nov.04, 2023
Remark: This report only for BLE.	

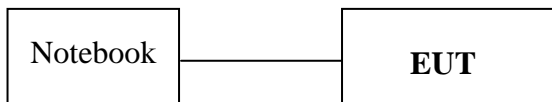
2.2.Feature of Equipment Under Test

Product Feature & Specification	
Product	Electronic paper display
Model No.	EP-C251
Radio	IEEE802.11 a/b/g/n/ac
Power Source	DC 15/20V
Bluetooth	
Radio	BDR +EDR; BLE
Frequency Range	2402-2480MHz
Type of Modulation	GFSK, $\pi/4$ DQPSK, 8DPSK
Data Rate	1Mbps, 2Mbps, 3Mbps
Quantity of Channels	79/40
Channel Separation	1MHz/2MHz
2.4GHz Wi-Fi	
Support Modes	802.11b/g/n20
Frequency Range	2412-2462MHz
Type of Modulation	802.11b(DSSS): CCK, QPSK, BPSK; 802.11g/n(OFDM): 64QAM,16QAM, QPSK, BPSK
Data Rate	802.11b: 1/2/5.5/11 Mbps; 802.11g: 6/9/12/18/24/36/48/54 Mbps; 802.11n: up to 75Mbps
Channel Separation	5MHz
5GHz Wi-Fi	
Support Modes	802.11a/n20/n40/ac20/ac40/ac80
Frequency Range	5180-5240MHz, 5260-5320MHz, 5500-5700MHz, 5745-5825MHz
Type of Modulation	802.11a/n (OFDM): QPSK, BPSK, 16QAM, 64QAM 802.11ac (OFDM): QPSK, BPSK, 16QAM, 64QAM,256QAM
Data Rate	802.11a: 6/9/12/18/24/36/48/54 Mbps; 802.11n: up to 150Mbps; 802.11ac: up to 433Mbps
Channel Separation	5MHz
Antenna System	
Type of Antenna	shrapnel Antenna
Antenna Number	1
Antenna Peak Gain	Bluetooth Peak Gain: 2.69dBi. DTS/DSS Band Peak Gain: 2.69dBi. U-NII-1 Band Peak Gain: 1.87dBi. U-NII-2A Band Peak Gain: 2.28dBi. U-NII-2C Band Peak Gain: 2.28dBi. U-NII-3 Band Peak Gain: 2.22dBi.

2.3. Tested Supporting System Details

No.	Description	ACS No.	Manufacturer	Model	Serial Number
1.	Notebook	N/A	ACER	ZOW	N/A
Power Cord(3C): Unshielded, Detachable, 1.8m Power Adapter: Manufacturer: Lite-On, M/N: PA-1900-32 Data Cable: Unshielded, Undetectable, 4.0m(Bond one ferrite core)					

2.4. Block Diagram of connection between EUT and simulators



(EUT: Electronic paper display)

2.5. Test information

A special software (Ampak RFTTestTool, VER:7.0) was used to control EUT work in TX mode (GFSK modulation), and select test channel.

Tested mode, channel, and data rate information			
Mode	data rate (Mbps)	Channel	Frequency (MHz)
Tx Mode GFSK modulation	1,2	Low :CH0	2402
	1,2	Middle: CH19	2440
	1,2	High: CH39	2480

2.6. Test Facility

Site Description

Name of Firm

: Audix Technology (Shenzhen) Co., Ltd.
 No. 6, Kefeng Road, Science & Technology Park,
 Nanshan District , Shenzhen, Guangdong, China

EMC Lab.

: Certificated by ISED, Canada
 Company Number: 5183A
 CAB identifier: CN0034
 Valid Date: Mar.31, 2024

Certificated by FCC, USA
 Designation No.: CN5022
 Valid Date: Mar.31, 2024

Accredited by NVLAP, USA
 NVLAP Code: 200372-0
 Valid Date: Mar.31, 2024

2.7. Measurement Uncertainty (95% confidence levels, k=2)

Test Item	Uncertainty
Uncertainty for Conduction emission test in No. 1 Conduction	$\pm 2.6\text{dB}(150\text{KHz to } 30\text{MHz})$
Uncertainty for Radiation Emission test in 3m chamber	$\pm 3.8\text{dB}(30\sim 200\text{MHz, Polarization: H})$
	$\pm 3.8\text{dB}(30\sim 200\text{MHz, Polarization: V})$
	$\pm 4.0\text{dB}(200\text{M}\sim 1\text{GHz, Polarization: H})$
	$\pm 4.0\text{dB}(200\text{M}\sim 1\text{GHz, Polarization: V})$
Uncertainty for Radiation Emission test in 3m chamber(1GHz-18GHz)	$\pm 4.0\text{dB}(1\sim 6\text{GHz, Distance: } 3\text{m})$
	$\pm 4.0\text{dB}(6\sim 18\text{GHz, Distance: } 3\text{m})$
Uncertainty for Radiated Spurious Emission test in RF chamber	$\pm 3.7\text{dB}(30\text{MHz}\sim 1000\text{MHz})$
	$\pm 3.3\text{dB}(1\sim 26.5\text{GHz})$
Uncertainty for Conduction Spurious emission test	$\pm 2.0\text{dB}$
Uncertainty for Output power test	$\pm 0.8\text{dB}$
Uncertainty for Bandwidth test	$\pm 4.6\%$
Uncertainty for DC power test	$\pm 0.1\%$
Uncertainty for test site temperature and humidity	$\pm 0.6^\circ\text{C}$
	$\pm 3\%$

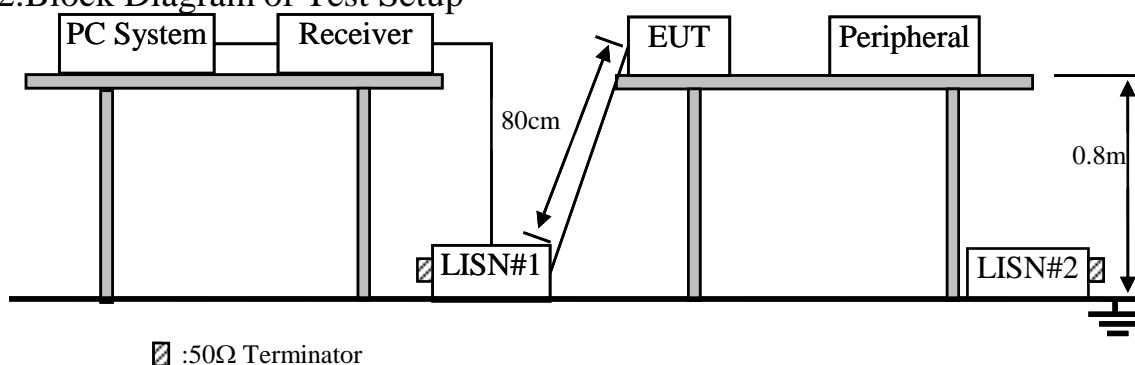
3. POWER LINE CONDUCTED EMISSION TEST

3.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	1# Shielding Room	AUDIX	N/A	N/A	Nov.09,22	3 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100842	Apr.01,23	1 Year
3.	L.I.S.N.#1	Rohde & Schwarz	ENV216	102160	Jun.25,23	1 Year
4.	RF Cable	Eastsheep	RG223	190424	Sep.15,23	1Year
5.	Test Software	AUDIX	e3	6.100913a	N/A	N/A

Note: N/A means Not applicable.

3.2. Block Diagram of Test Setup



3.3. Power Line Conducted Emission Test Limits

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limits shall apply at the transition frequencies.

3. Emission Level (dBμV) = Factor (L.I.S.N.) (dB) + Cable Loss (dB)+Reading (Receiver) (dBμV)

3.4. Configuration of EUT on Test

The following equipment are installed on Power Line Conducted Emission Test to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

3.4.1. Electronic paper display (EUT)

Model No. : EP-C251

3.4.2. Support Equipment: As Tested Supporting System Details, in Section 2.3.

3.5. Operating Condition of EUT

- 3.5.1. Setup the EUT as shown as Section 3.2.
- 3.5.2. Turn on the power of EUT.
- 3.5.3. PC run test software to control EUT work in Tx mode.

3.6. Test Procedure

The EUT was placed on a non-metallic table, 80cm above the ground plane. The EUT Power Via Adaptor connected to the power mains through a line impedance stabilization network (L.I.S.N. #1). This provides a 50 ohm coupling impedance for the EUT (Please refer the block diagram of the test setup and photographs). The AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10 on Conducted Emission Test.

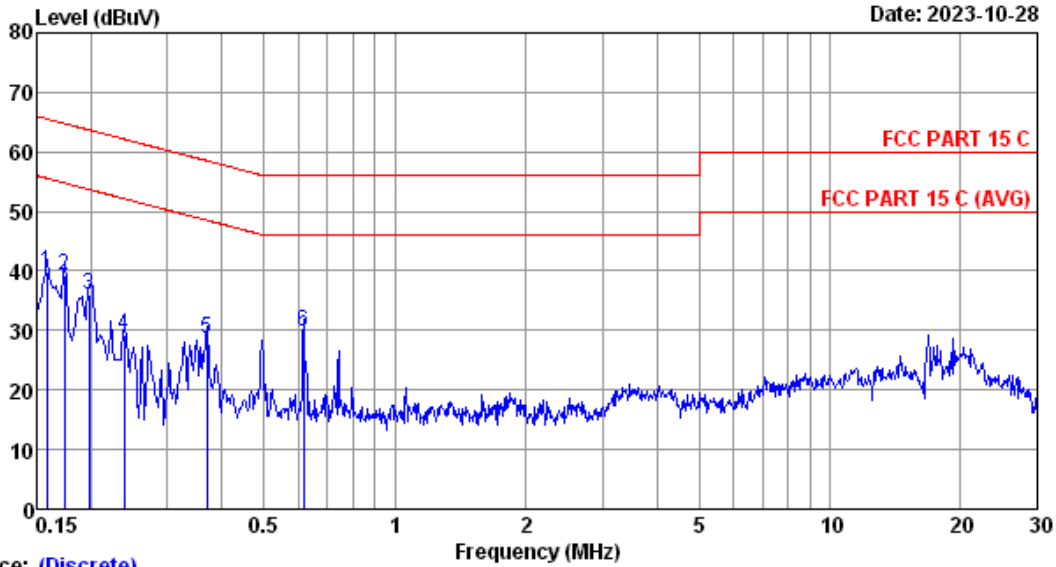
The bandwidth of test receiver (R & S ESCI) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

3.7. Power Line Conducted Emission Test Results

PASS. (All emissions not reported below are too low against the prescribed limits.)

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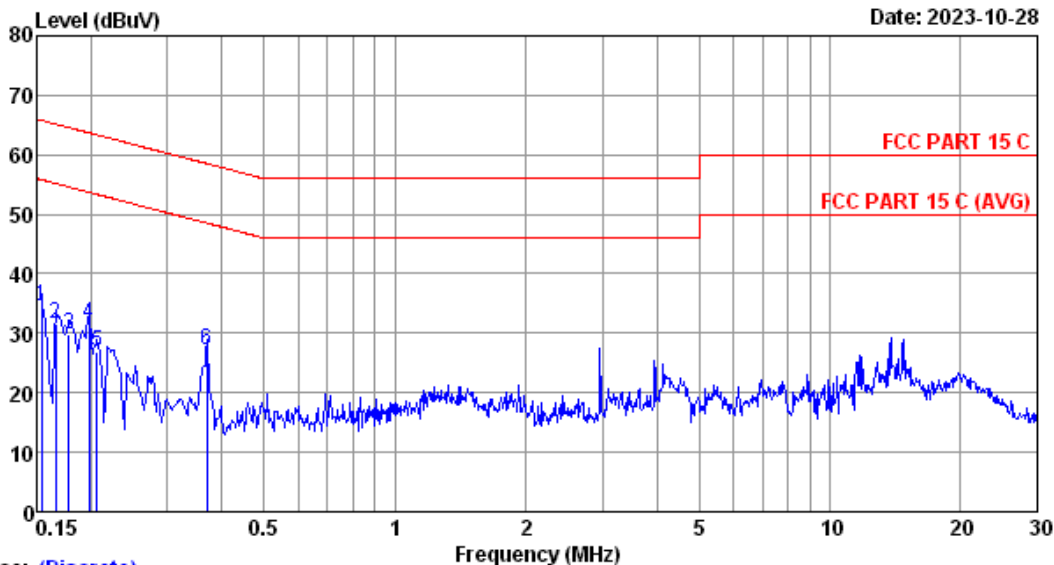
Trace: (Discrete)

Site no :1# CE Data No :3
 Dis./Lisn :2023 ENV216-L
 Limit :FCC PART 15 C
 Env./Ins. :21.6°C/52% Engineer :Sucy
 Power Rating :AC 120V/60Hz
 Test Mode :BLE TX Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.158	9.62	0.01	30.30	39.93	65.56	25.63	QP
2	0.174	9.62	0.01	29.72	39.35	64.77	25.42	QP
3	0.198	9.62	0.01	26.27	35.90	63.71	27.81	QP
4	0.238	9.61	0.01	19.55	29.17	62.17	33.00	QP
5	0.369	9.60	0.01	19.00	28.61	58.52	29.91	QP
6	0.617	9.57	0.01	20.32	29.90	56.00	26.10	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
 2.If the average limit is met when using a quasi-peak detector.
 the EUT shall be deemed to meet both limits and measurement
 with average detector is unnecessary.

Data: 4 File: E:\1#CE\2023 Report Data\T\TPVA1Z2310044-RF\C251-FCC.EM6 (8) Date: 2023-10-28



Trace: (Discrete)

Site no :1# CE Data No :4
 Dis./Lisn :2023 ENV216-N
 Limit :FCC PART 15 C
 Env./Ins. :21.6°C/52% Engineer :Sucy
 Power Rating :AC 120V/60Hz
 Test Mode :BLE TX Mode

No	Freq (MHz)	LISN Factor (dB)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV)	Limits (dBuV)	Margin (dB)	Remark
1	0.154	9.69	0.01	24.78	34.48	65.78	31.30	QP
2	0.166	9.69	0.01	21.78	31.48	65.16	33.68	QP
3	0.178	9.70	0.01	20.15	29.86	64.59	34.73	QP
4	0.198	9.70	0.01	21.88	31.59	63.71	32.12	QP
5	0.206	9.70	0.01	17.29	27.00	63.36	36.36	QP
6	0.369	9.72	0.01	17.32	27.05	58.52	31.47	QP

Remarks: 1.Emission Level=LISN Factor+Cable Loss+Reading.
 2.If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

4. RADIATED EMISSION MEASUREMENT

4.1. Test Equipments

Frequency range: 30~1000MHz

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3m Chamber(NSA)	AUDIX	N/A	N/A	Aug.11,22	3Year
2.	3m Chamber(SE)	AUDIX	N/A	N/A	Sep.16,22	3 Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	103670	Jun.25,23	1 Year
4.	Tri-log-Broadband Antenna	SCHWARZBECK	VULB 9168	429	Oct.10,23	1 Year
5.	NSA Cable	HUBER+SUHNER	CFD400NL-LW	No.3+190411	Sep.20,23	1 Year
6.	Coaxial Switch	Anritsu	MP59B	6201397223	Apr.02,23	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESR3	101931	Apr.01,23	1 Year
8.	Broadband Amplifier	SCHWARZBECK	BBV9744	00259	Jun.25,23	1 Year
9.	Test Software	AUDIX	e3	6.100913a	N/A	N/A

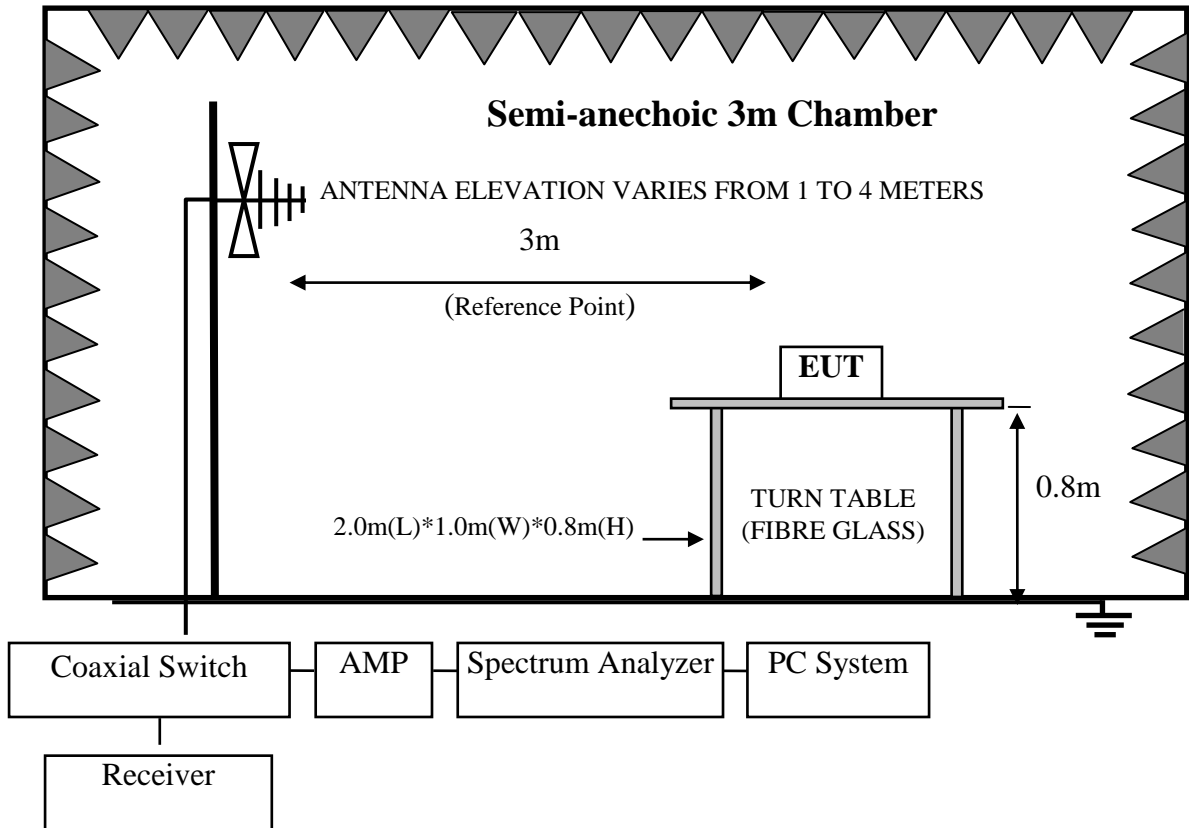
Note: N/A means Not applicable.

Frequency range: above 1000MHz

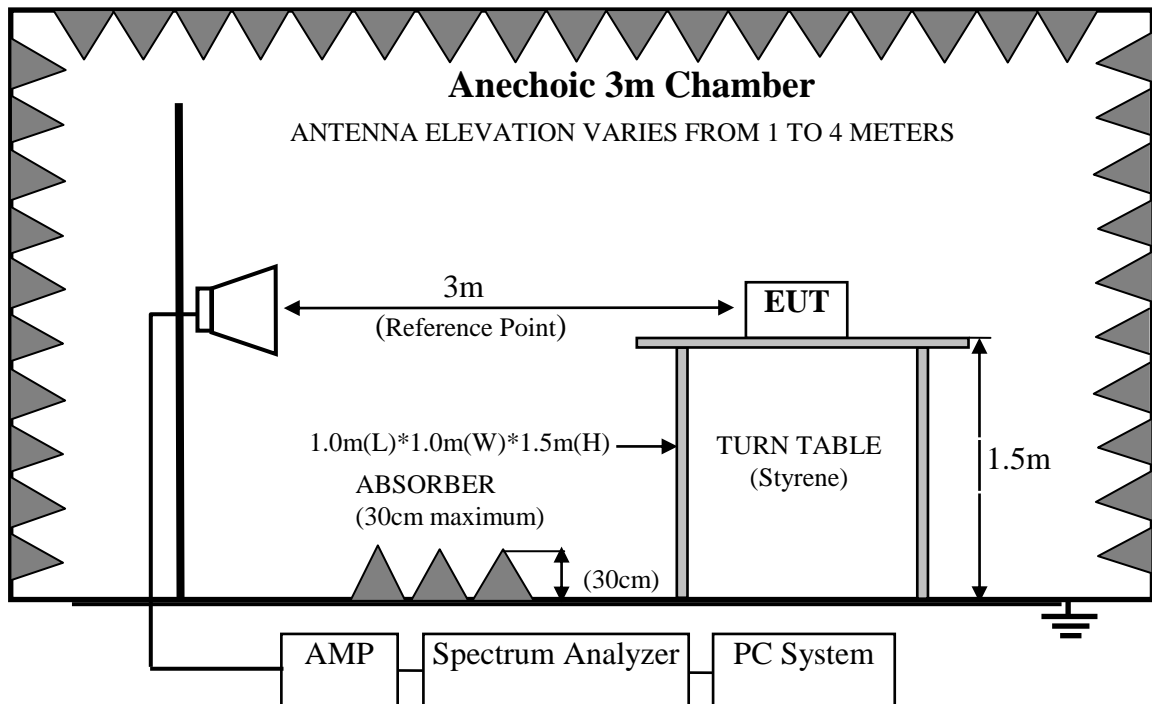
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3mChamber(Svswr)	AUDIX	N/A	N/A	Aug.09,22	3Year
2.	3mChamber(SE)	AUDIX	N/A	N/A	Sep.16,22	3Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.01,23	1 Year
4.	Amplifier	Agilent	83017A	MY53270084	Sep.20,23	1 Year
5.	RF Cable	EMCI	EMC104-SM-S M-15000	190407	Jun.25,23	1 Year
6.	Test Software	AUDIX	e3	6.100913a	N/A	N/A
7.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Aug.23,23	1 Year

Note: N/A means Not applicable.

4.2. Block Diagram of Test Setup
For frequency range 30MHz-1000MHz



For frequency range 1GHz-25GHz



4.3. Radiated Emission Limits Standard:

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000MHz	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

- Remark :
- (1) Emission Level (dBμV/m) = Reading (Receiver) (dBμV) + Antenna Factor (dB/m) + Cable Loss (dB)
Emission Level (dBμV/m) = Reading (Spectrum) (dBμV) + Antenna Factor (dB/m) – Amp Factor (dB) + Cable Loss (dB)(above 1000MHz)
 - (2) The smaller limits shall apply at the cross point between two frequency bands.
 - (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.
 - (4) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

4.4. EUT Configuration on Test

The following equipment are installed on Radiated Emission Test to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

4.4.1. Electronic paper display (EUT)

Model Number : EP-C251
Serial Number : N/A

4.5. Operating Condition of EUT

- 4.5.1. Setup the EUT and simulator as shown as Section 4.2.
- 4.5.2. Turn on the power of all equipments.
- 4.5.3. Let EUT work in BLE Tx mode.

4.6. Test Procedure

Frequency below 30MHz:

The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10 regulation.

Frequency Above 30MHz:

EUT and its simulators are placed on a turn table, which is 0.8 meter high above ground for frequency 30MHz~1000MHz, 1.5 meter high above ground for frequency above 1GHz and put the absorbing with 2.4m(L)*2.4m(W)*0.3m(H) on the ground . The turn table can rotate 360 degrees to determine the position of the maximum emission level. Power on the EUT and let it working in test mode, then test it.EUT is set 3 meters away from the receiving antenna, which is mounted on a antenna tower. The antenna can be moved up and down between 1 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna for frequency 30MHz~1000MHz, and the Horn antenna is used as receiving antenna for frequency above 1GHz. Both horizontal and vertical polarization of the antenna is set on Test. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.10 on radiated emission Test.

This test was performed with EUT in X, Y, Z position, and the worse case was found reported in report.

The bandwidth of the EMI test receiver (R&S ESR3) is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's RBW is set at 1MHz and VBW is set at 3MHz for peak emissions measurement above 1GHz.

This device is pulse Modulated, a duty cycle factor was used to calculated average level based measured peak level.

The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

4.7. Radiated Emission Test Results

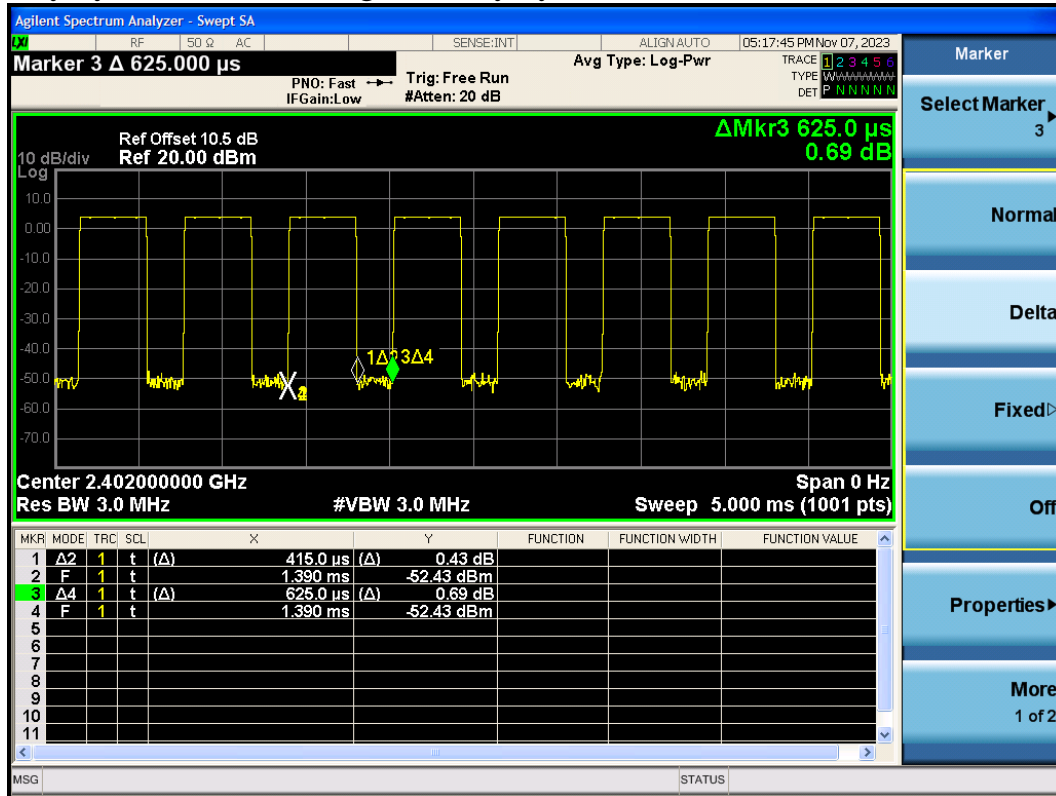
PASS.

All the emissions from 30MHz to 25GHz were comply with the 15.209 Limit.

Note: The duty cycle factor for calculate average level is BLE-1Mbps:-3.557dB; BLE-2Mbps:-8.543dB for BLE, and average limit is 20dB below peak limit, so if peak measured level comply with average limit, the average level was deemed to comply with average limit.

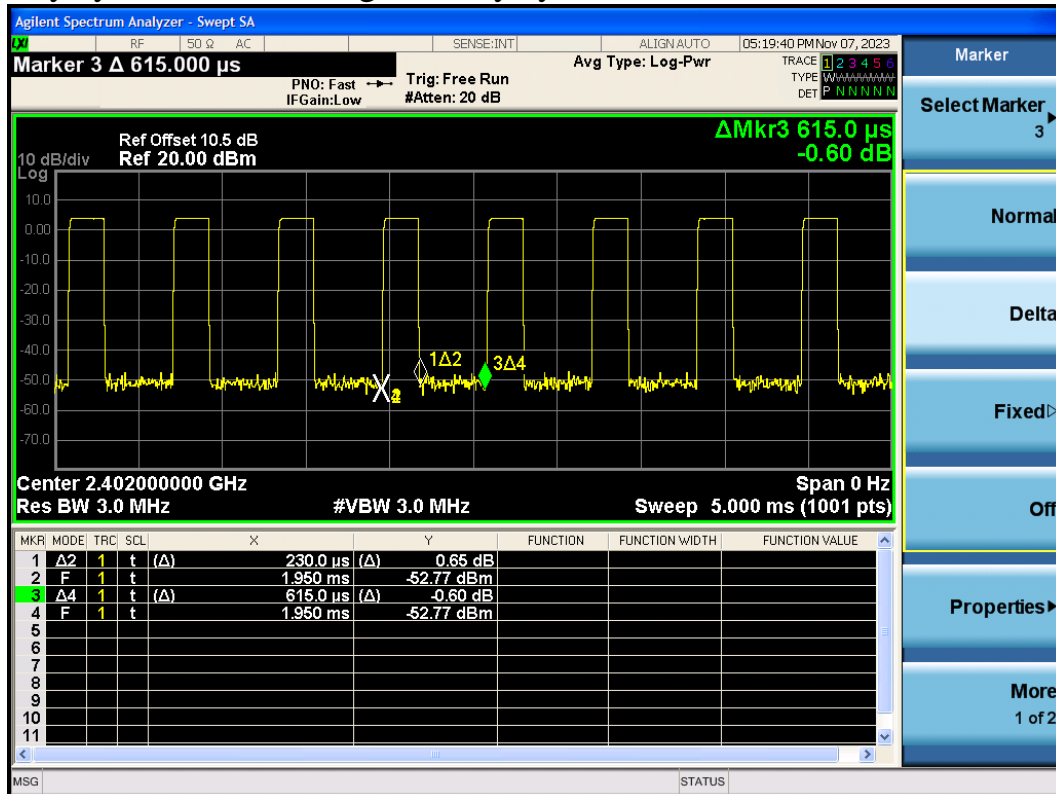
BLE-1Mbps:

Duty cycle factor = $20\log(1/\text{duty cycle}) = -3.557\text{dB}$



BLE-2Mbps:

Duty cycle factor = $20\log(1/\text{duty cycle}) = -8.543\text{dB}$

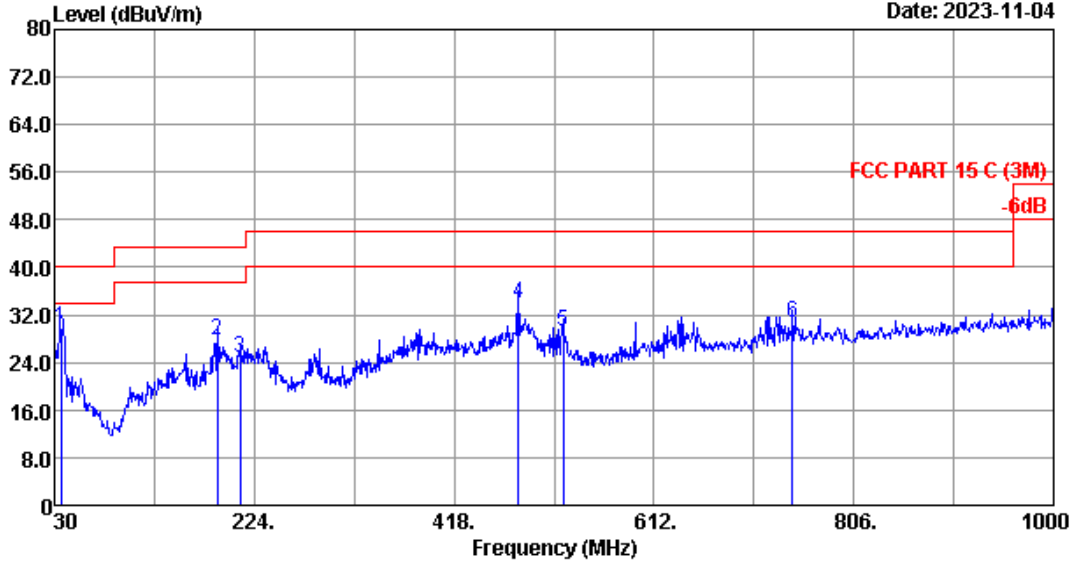


Frequency: 30MHz~1GHz

Data: 3

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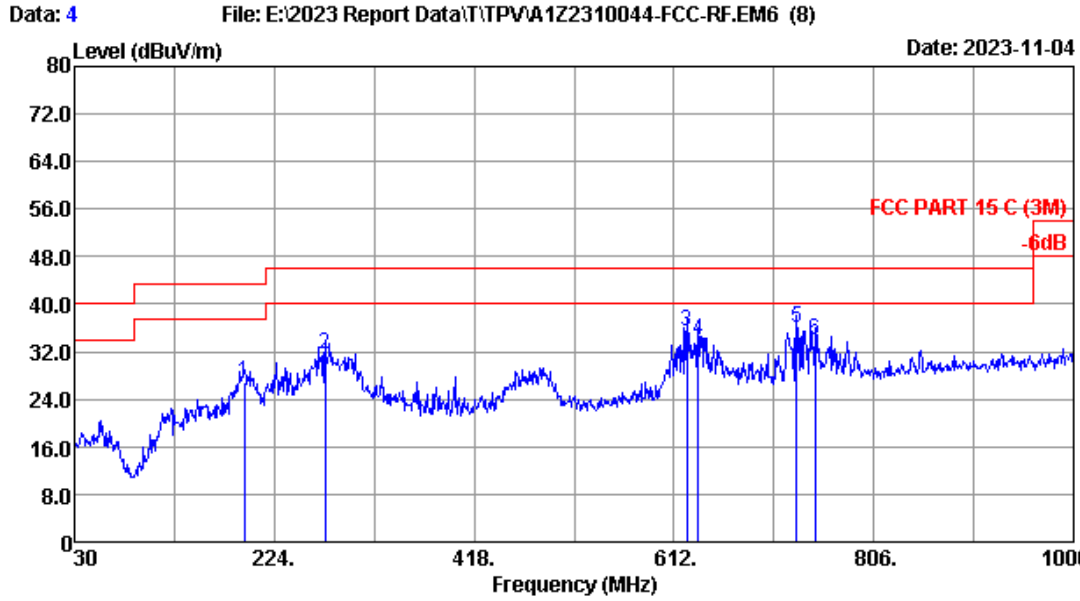
Date: 2023-11-04



Site no. : 3m Chamber Data no. : 3
 Dis. / Ant. : 3m 2023 VULB 9168-429 Ant. pol. : VERTICAL
 Limit : FCC PART 15 C (3M)
 Env. / Ins. : 23.6°C55% Engineer : Abel
 Test Mode : BLE TX Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	36.790	19.06	0.54	40.55	29.86	40.00	10.14	QP
2	188.110	17.09	1.13	38.95	27.70	43.50	15.80	QP
3	210.420	15.60	1.21	37.44	24.92	43.50	18.58	QP
4	480.080	23.40	1.79	38.66	34.03	46.00	11.97	QP
5	523.730	24.00	1.88	33.23	29.26	46.00	16.74	QP
6	746.830	28.40	2.29	29.25	30.63	46.00	15.37	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.



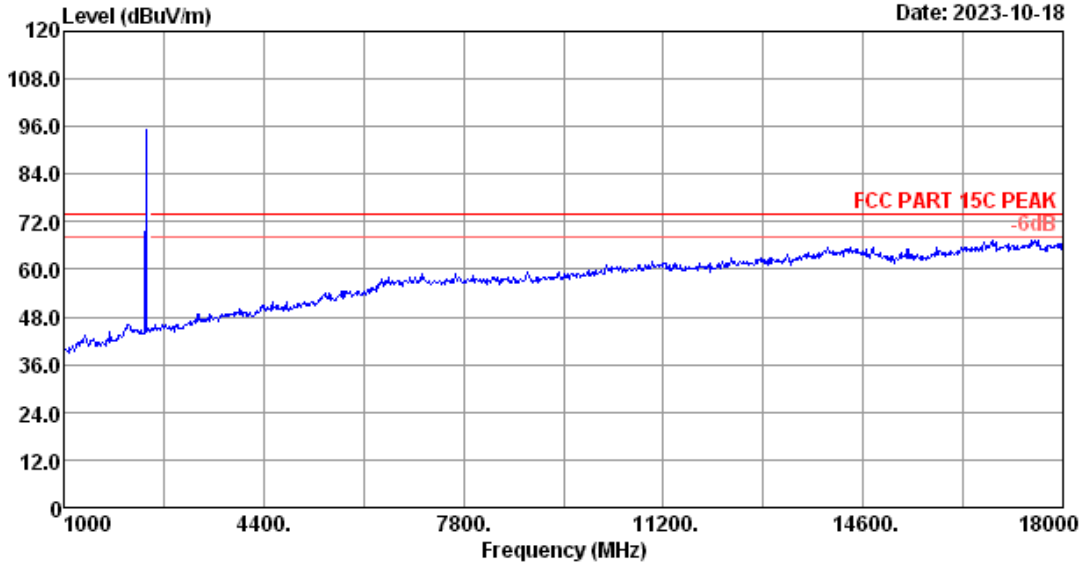
Site no. : 3m Chamber Data no. : 4
 Dis. / Ant. : 3m 2023 VULB 9168-429 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15 C (3M)
 Env. / Ins. : 23.6°C55% Engineer : Abel
 Test Mode : BLE TX Mode

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	194.900	16.51	1.15	38.75	26.98	43.50	16.52	QP
2	273.470	18.74	1.37	40.66	31.69	46.00	14.31	QP
3	624.610	26.21	2.10	36.84	35.50	46.00	10.50	QP
4	635.280	26.40	2.13	35.01	33.91	46.00	12.09	QP
5	731.310	27.45	2.27	35.80	36.15	46.00	9.85	QP
6	748.770	28.40	2.30	32.53	33.93	46.00	12.07	QP

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading.
 2. The emission levels that are 20dB below the official limit are not reported.

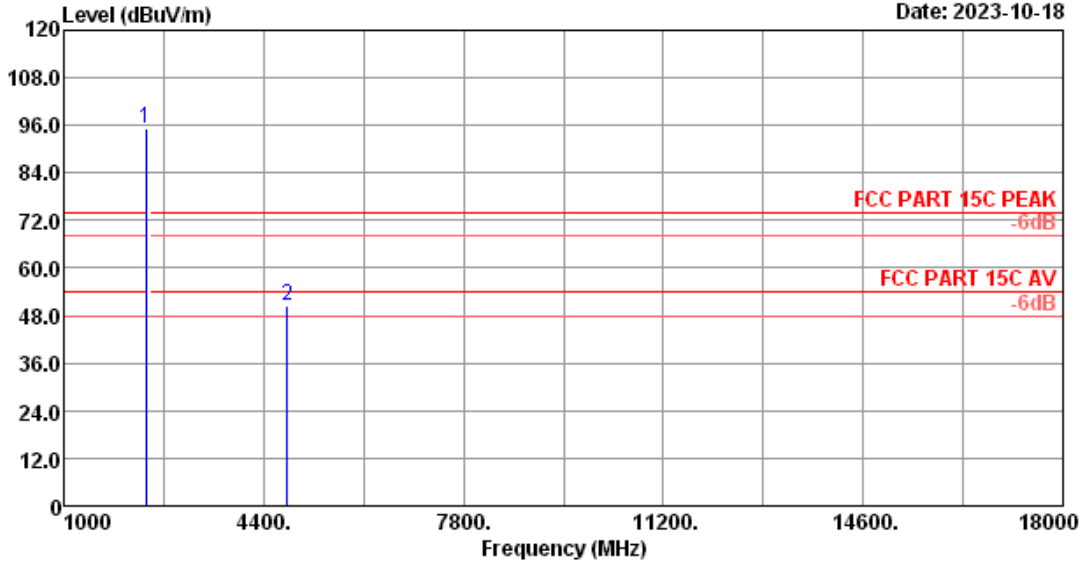
Frequency: 1GHz~18GHz
BLE-1Mbps:

Data: 41 File: F:\2023 Report\IT\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



Site no.	: 3m Chamber	Data no.	: 41
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0*C/51.1%	Engineer	: nier
Test Mode	: BLE1M 2402MHz TX		

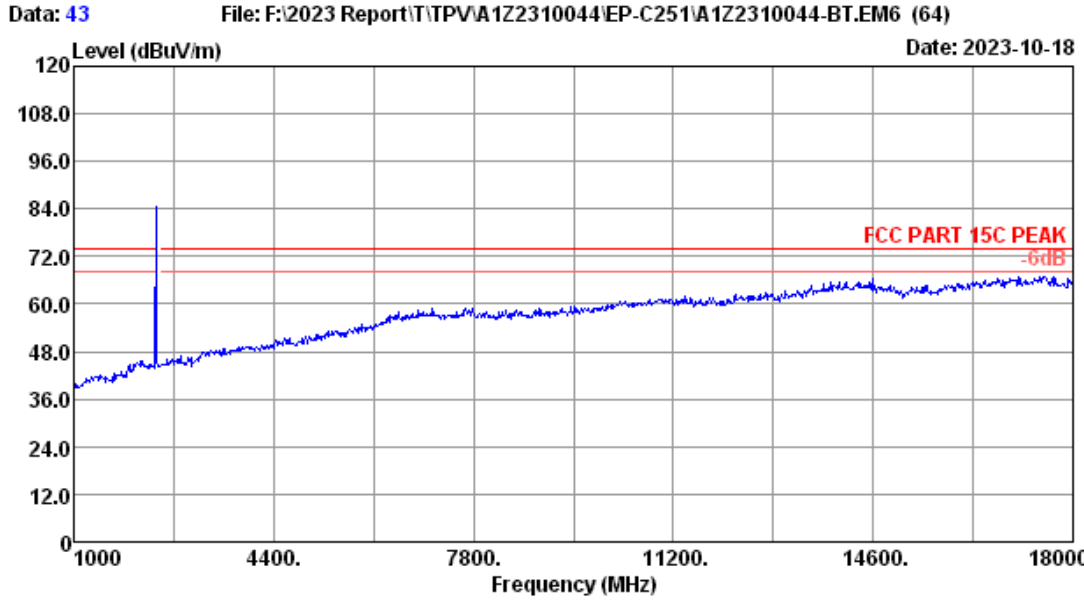
Data: 42 File: F:\2023 Report\IT\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



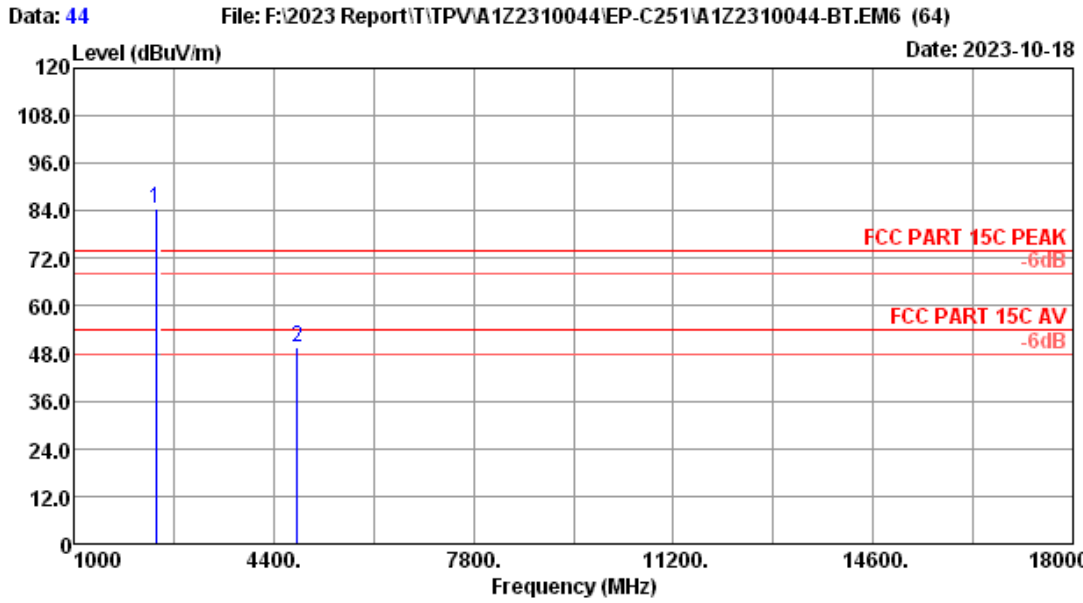
Site no. : 3m Chamber Data no. : 42
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	97.11	34.36	95.22	-----	-----	Peak
2	4804.00	31.20	6.50	46.26	33.68	50.28	74.00	23.72	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



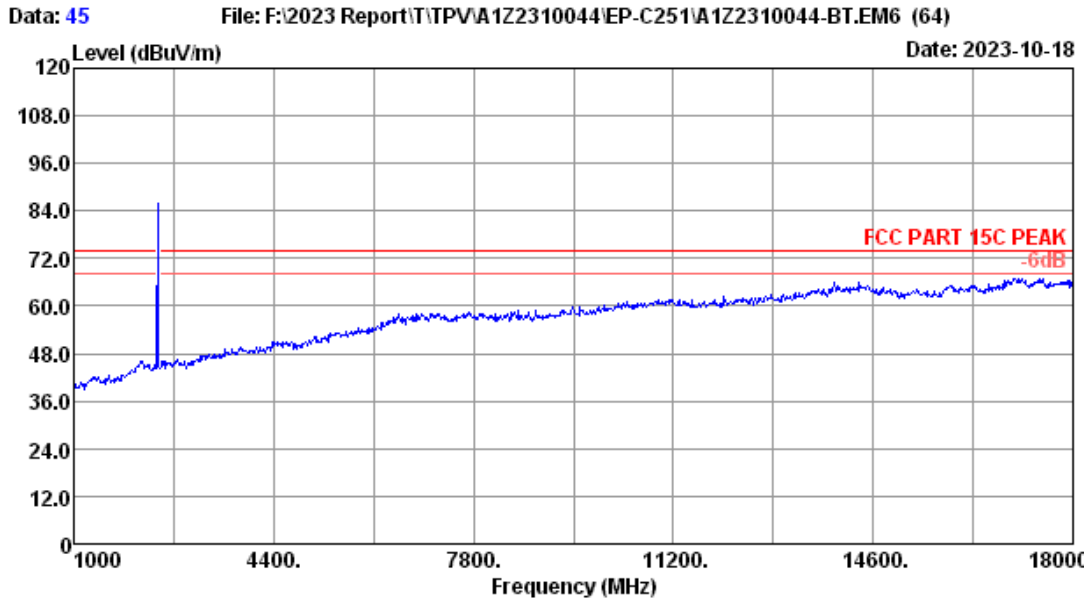
Site no.	: 3m Chamber	Data no.	: 43
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE1M 2402MHz TX		



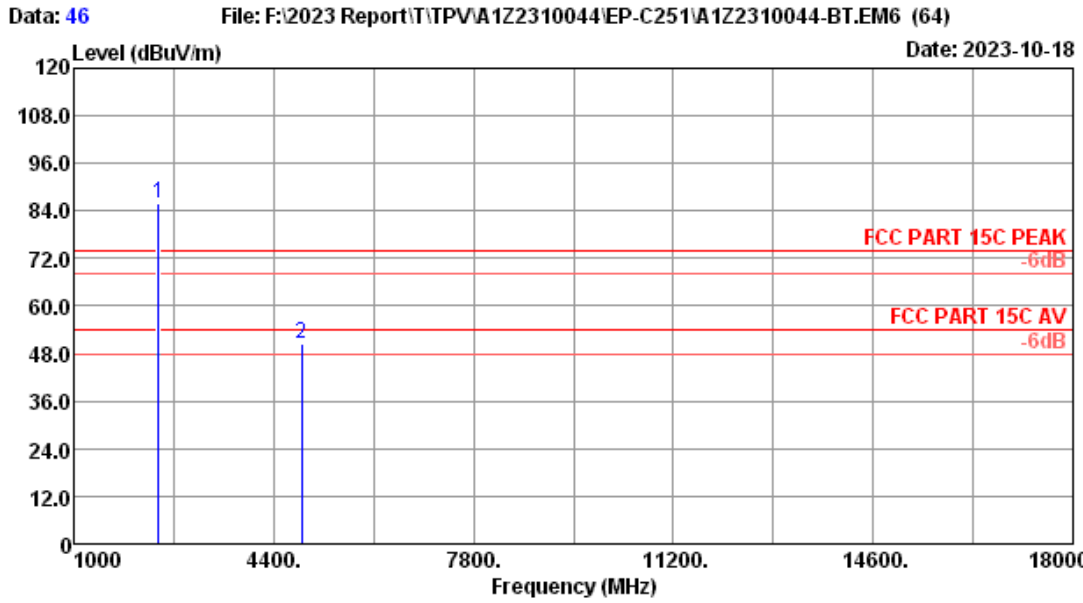
Site no. : 3m Chamber Data no. : 44
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	86.66	34.36	84.77	-----	-----	Peak
2	4804.00	31.20	6.50	45.68	33.68	49.70	74.00	24.30	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



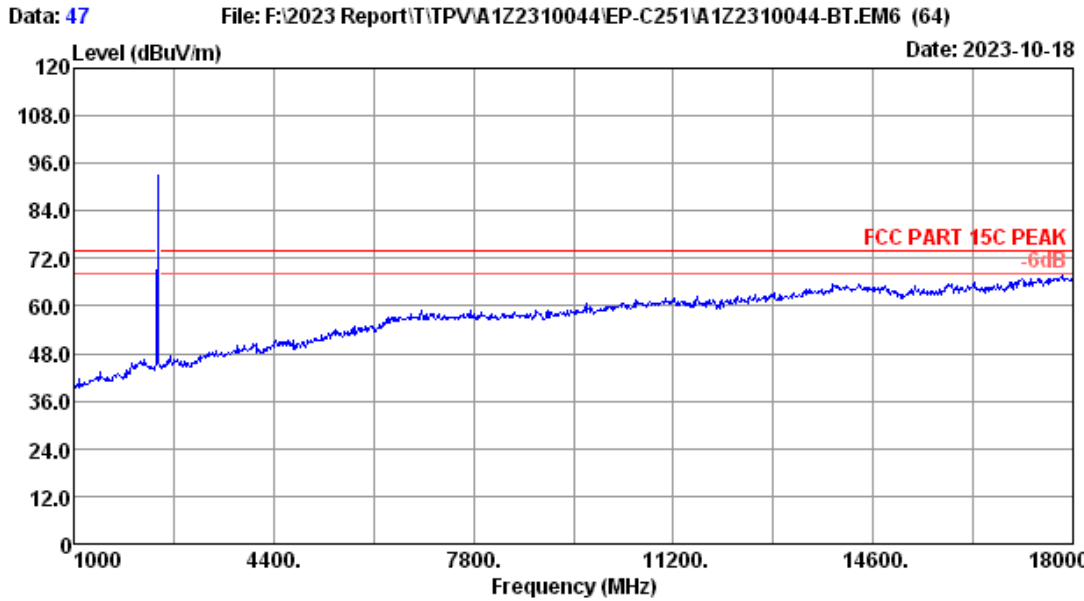
Site no.	: 3m Chamber	Data no.	: 45
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE1M 2440MHz TX		



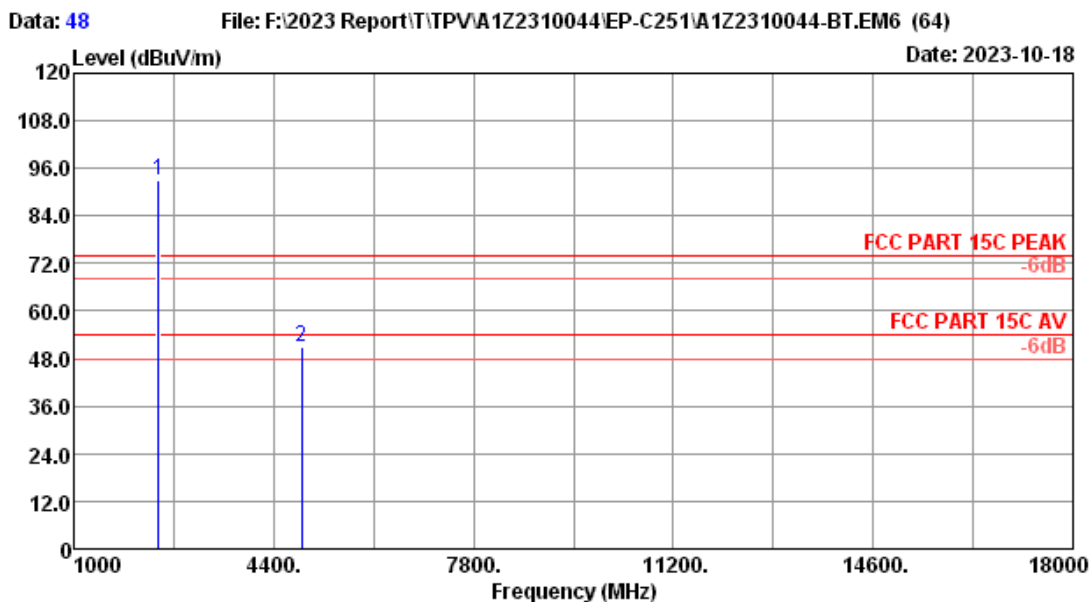
Site no. : 3m Chamber Data no. : 46
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2440MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.76	4.90	87.39	34.36	85.69	74.00	23.52	Peak
2	4880.00	31.44	6.54	46.19	33.69	50.48	74.00	23.52	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



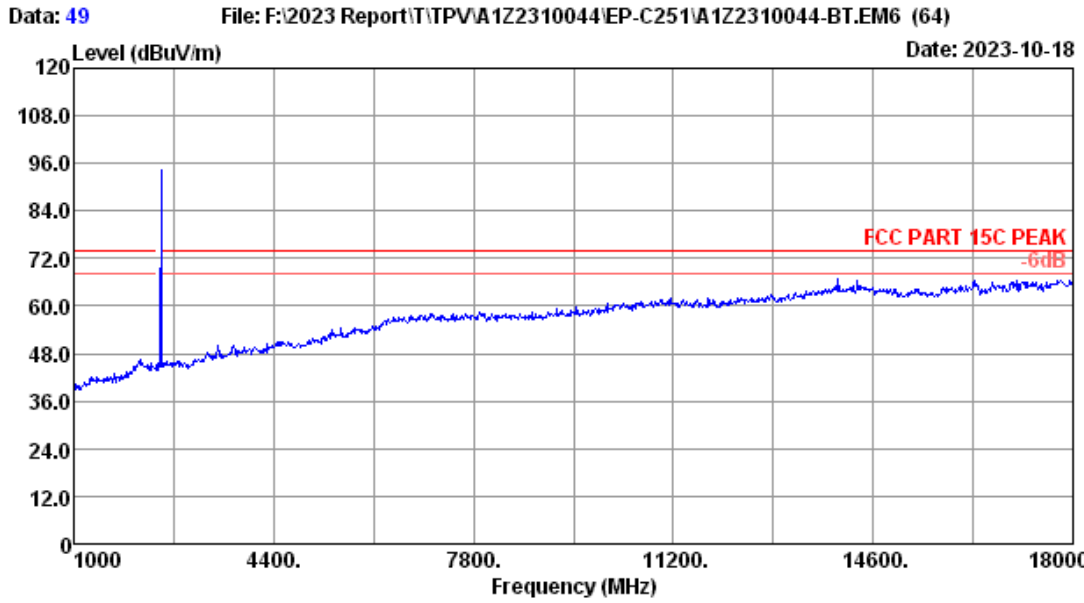
Site no.	: 3m Chamber	Data no.	: 47
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE1M 2440MHz TX		



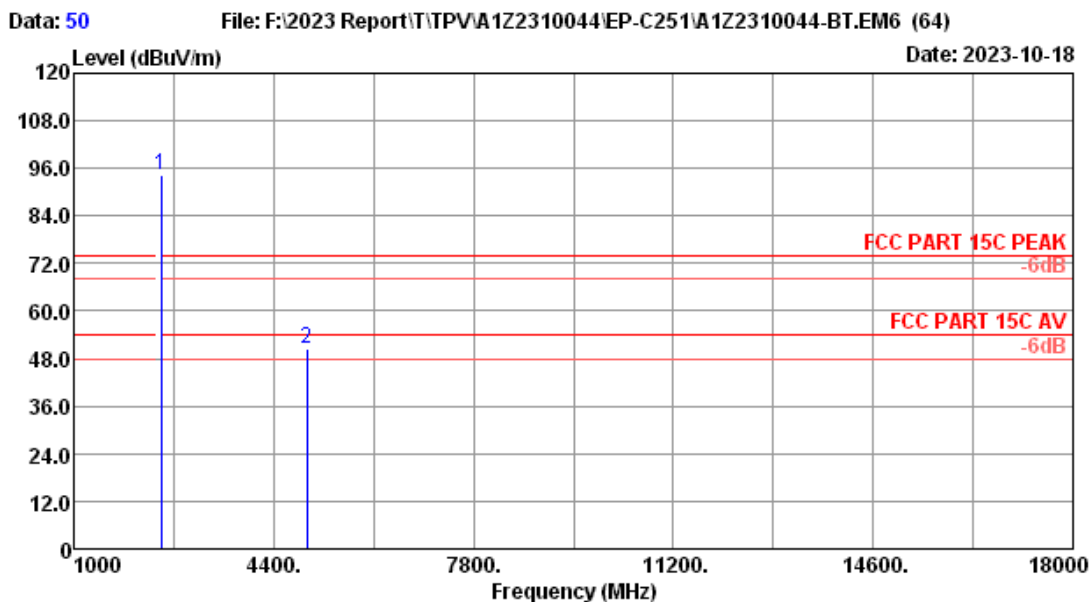
Site no. : 3m Chamber Data no. : 48
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2440MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.76	4.90	94.81	34.36	93.11	74.00	23.23	Peak
2	4880.00	31.44	6.54	46.48	33.69	50.77	50.77	0.00	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



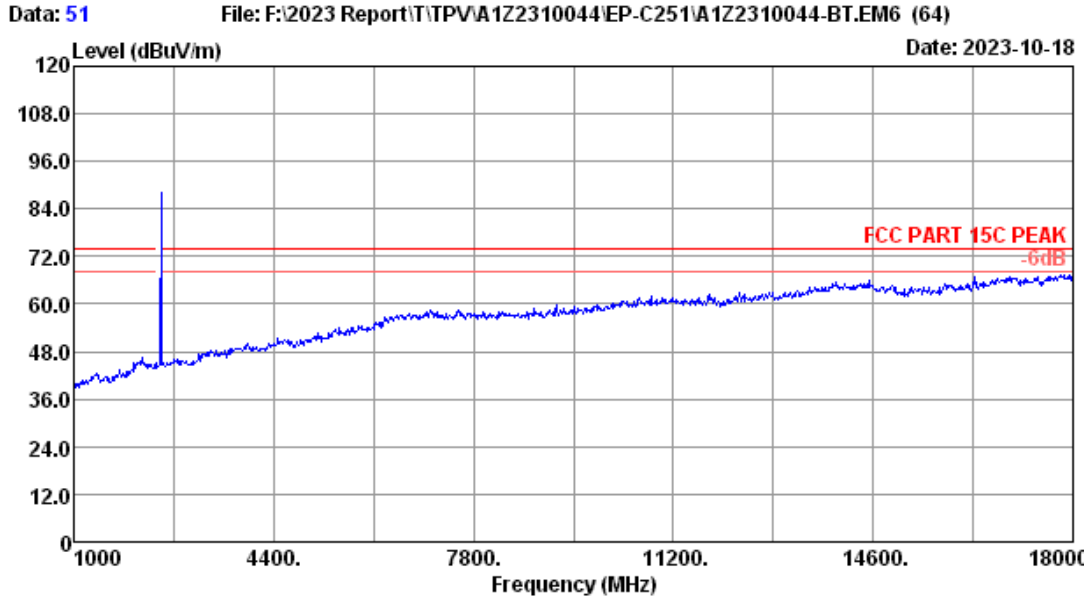
Site no. : 3m Chamber	Data no. : 49
Dis. / Ant. : 3m 2023 MCTD1209-3006	Ant. pol. : VERTICAL
Limit : FCC PART 15C PEAK	
Env. / Ins. : 21.0°C/51.1%	Engineer : nier
Test Mode : BLE1M 2480MHz TX	



Site no. : 3m Chamber Data no. : 50
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2480MHz TX

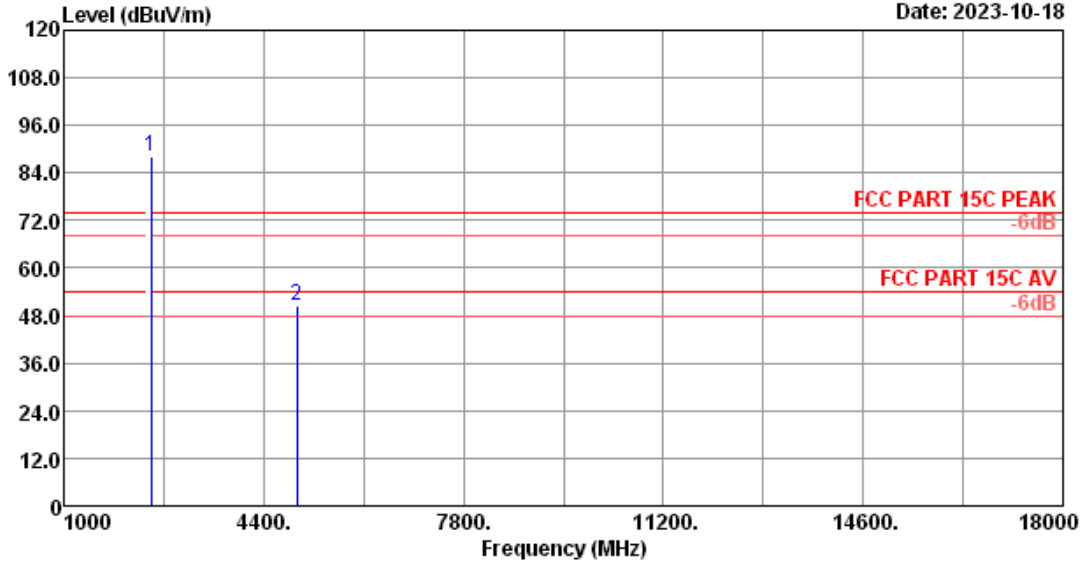
No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	95.72	34.35	94.10	-----	-----	Peak
2	4960.00	31.98	6.58	45.59	33.69	50.46	74.00	23.54	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 51
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE1M 2480MHz TX		

Data: 52 File: F:\2023 Report\IT\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



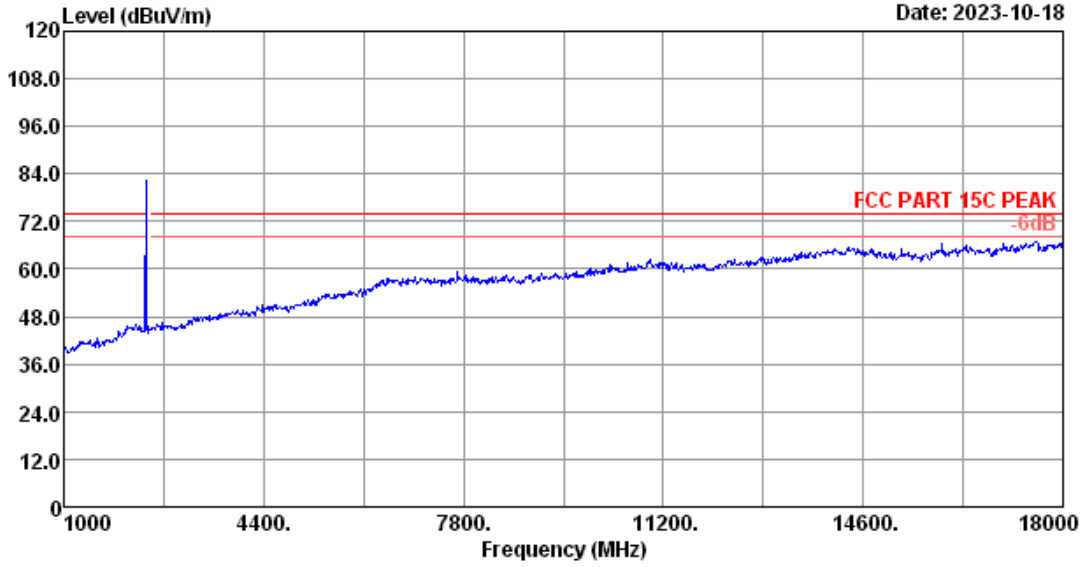
Site no. : 3m Chamber Data no. : 52
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	89.73	34.35	88.11	-----	-----	Peak
2	4960.00	31.98	6.58	45.68	33.69	50.55	74.00	23.45	Peak

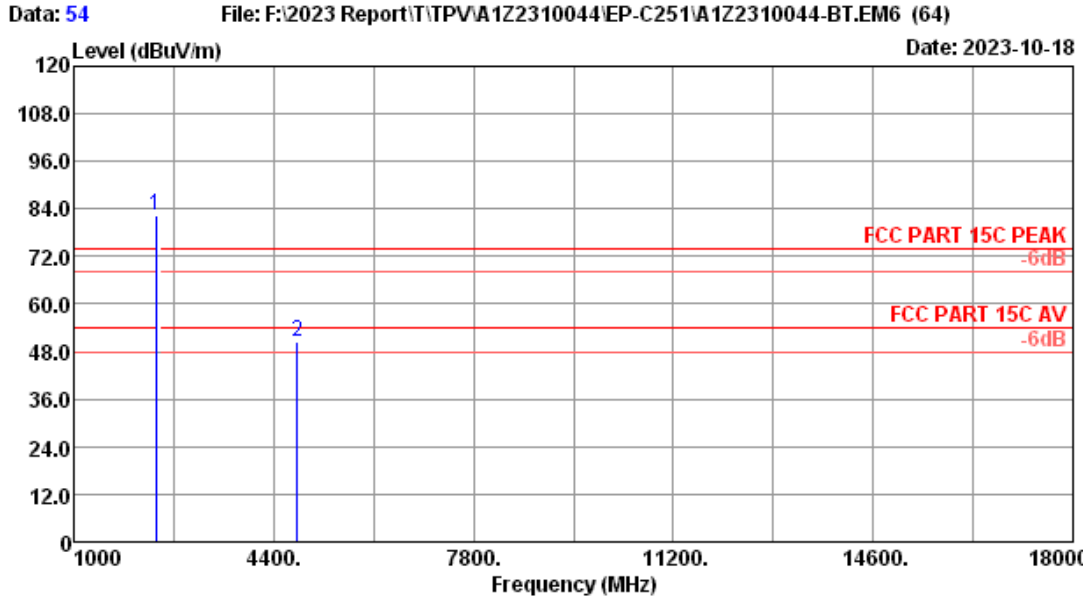
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

BLE-2Mbps:

Data: 53 File: F:\2023 Report\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



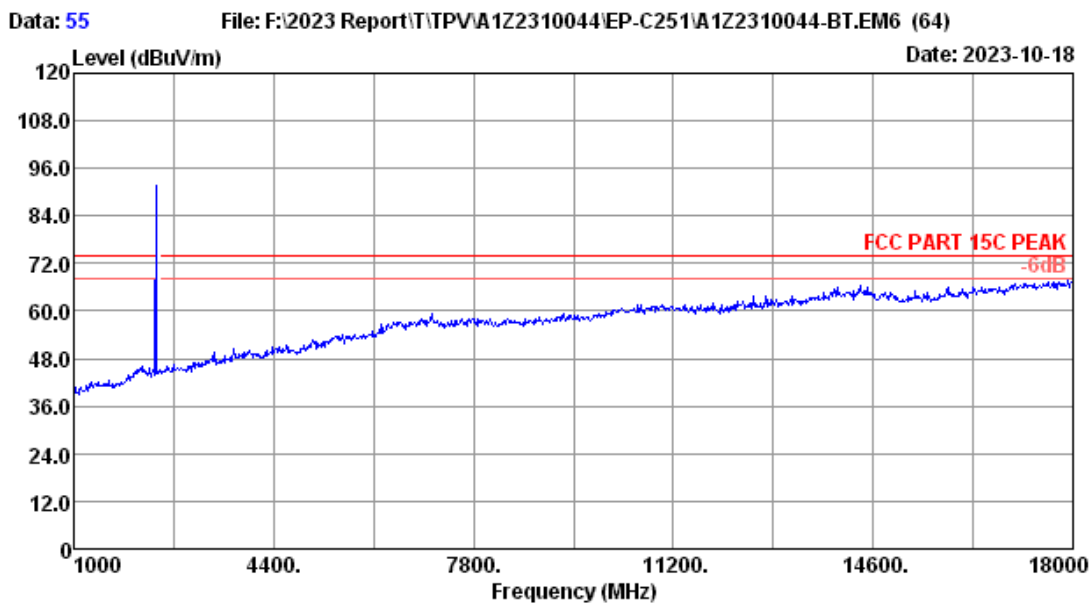
Site no.	: 3m Chamber	Data no.	: 53
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2402MHz TX		



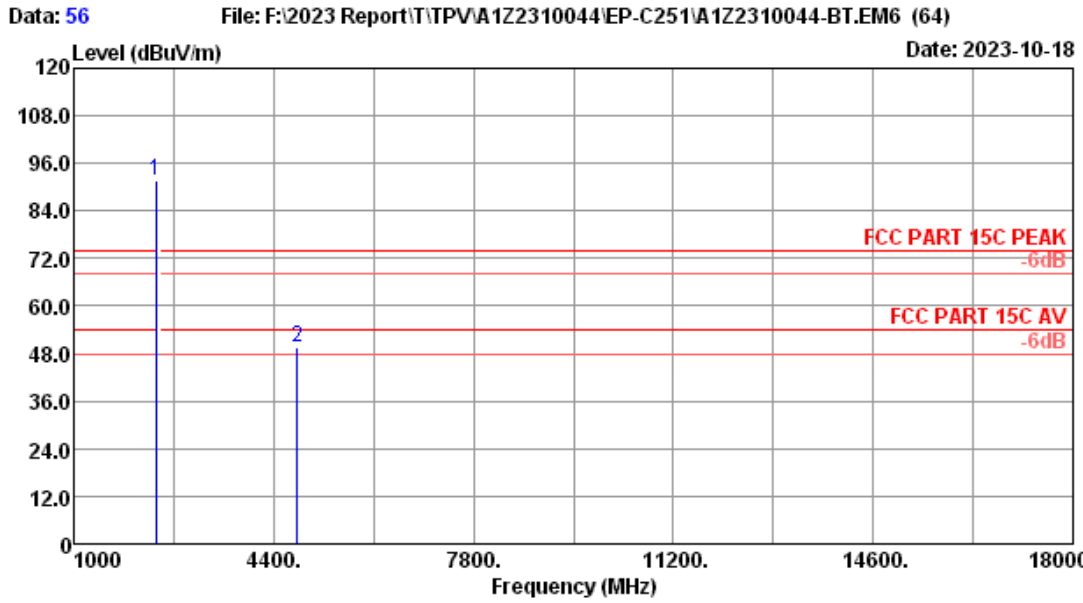
Site no. : 3m Chamber Data no. : 54
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	84.10	34.36	82.21	74.00	8.21	Peak
2	4804.00	31.20	6.50	46.29	33.68	50.31	74.00	23.69	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



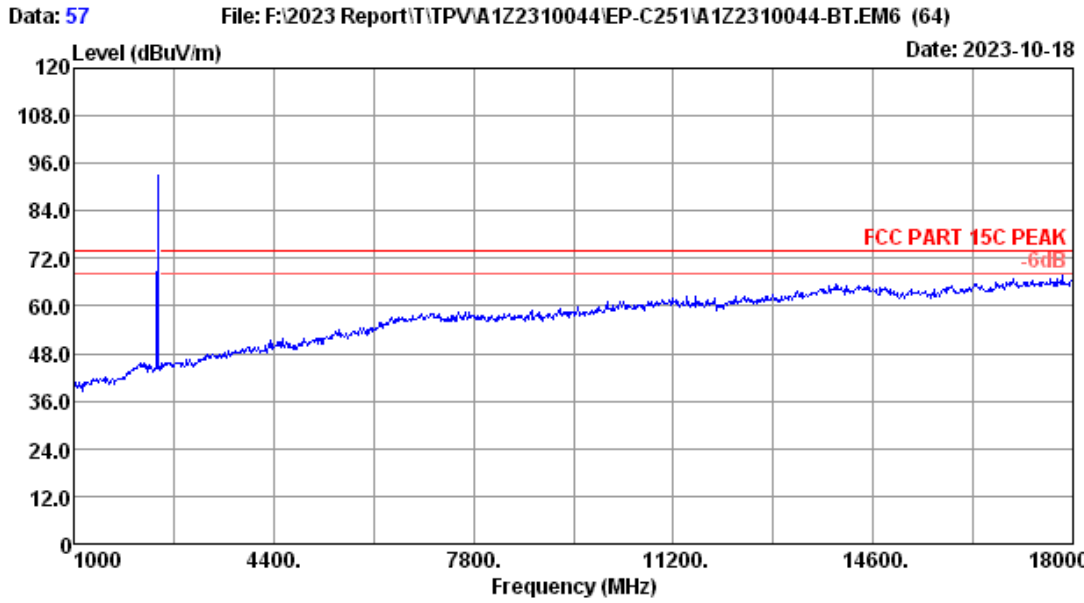
Site no.	: 3m Chamber	Data no.	: 55
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2402MHz TX		



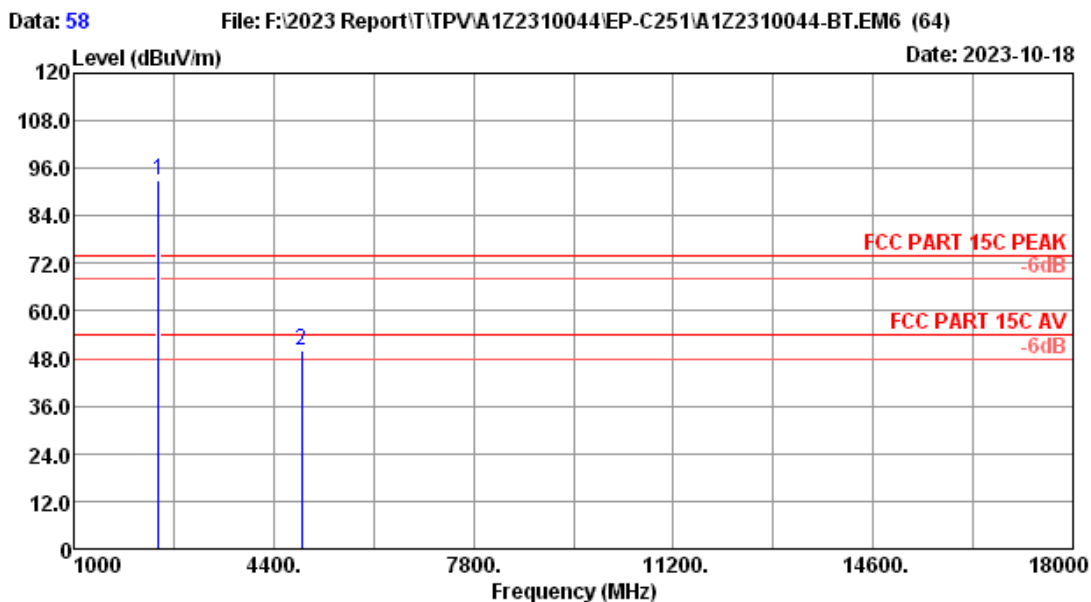
Site no. : 3m Chamber Data no. : 56
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2402.00	27.61	4.86	93.60	34.36	91.71	72.00	19.71	Peak
2	4804.00	31.20	6.50	45.73	33.68	49.75	48.00	1.75	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



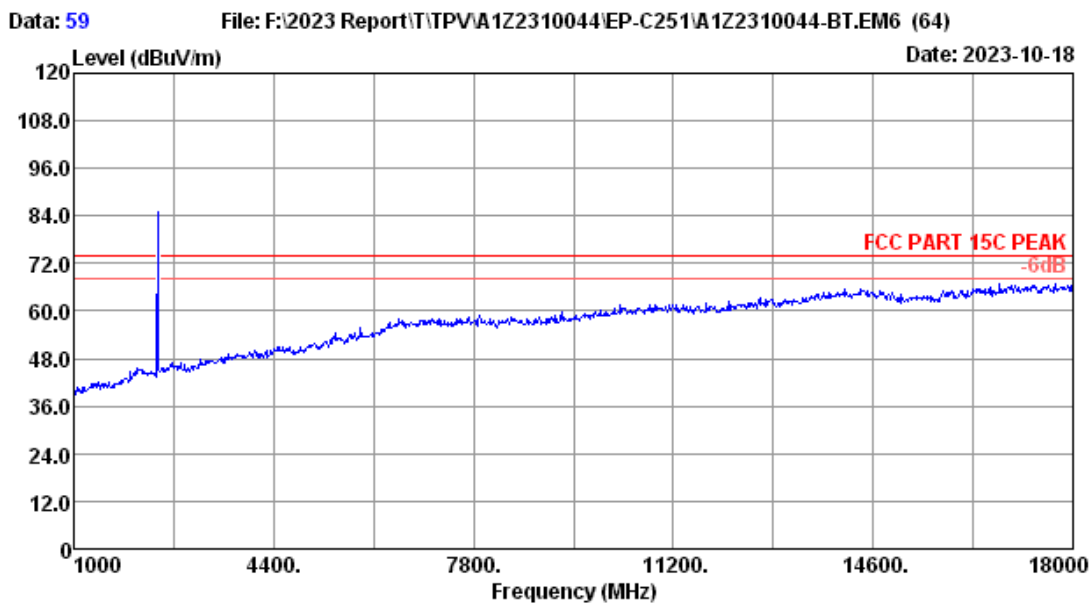
Site no.	: 3m Chamber	Data no.	: 57
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2440MHz TX		



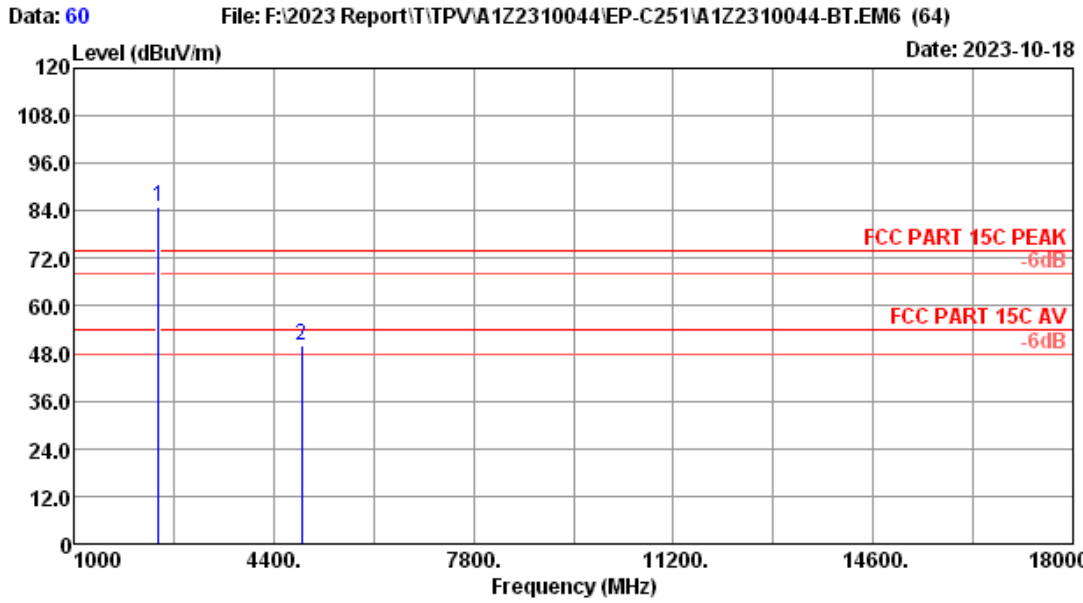
Site no. : 3m Chamber Data no. : 58
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2440MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.76	4.90	94.85	34.36	93.15	74.00	23.80	Peak
2	4880.00	31.44	6.54	45.91	33.69	50.20	74.00	23.80	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



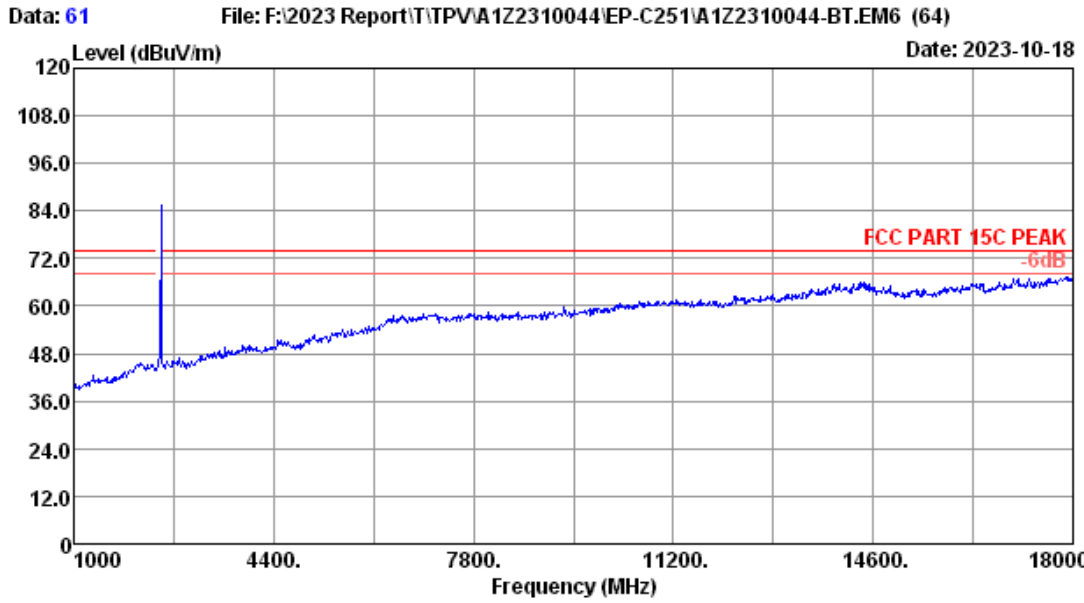
Site no.	: 3m Chamber	Data no.	: 59
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2440MHz TX		



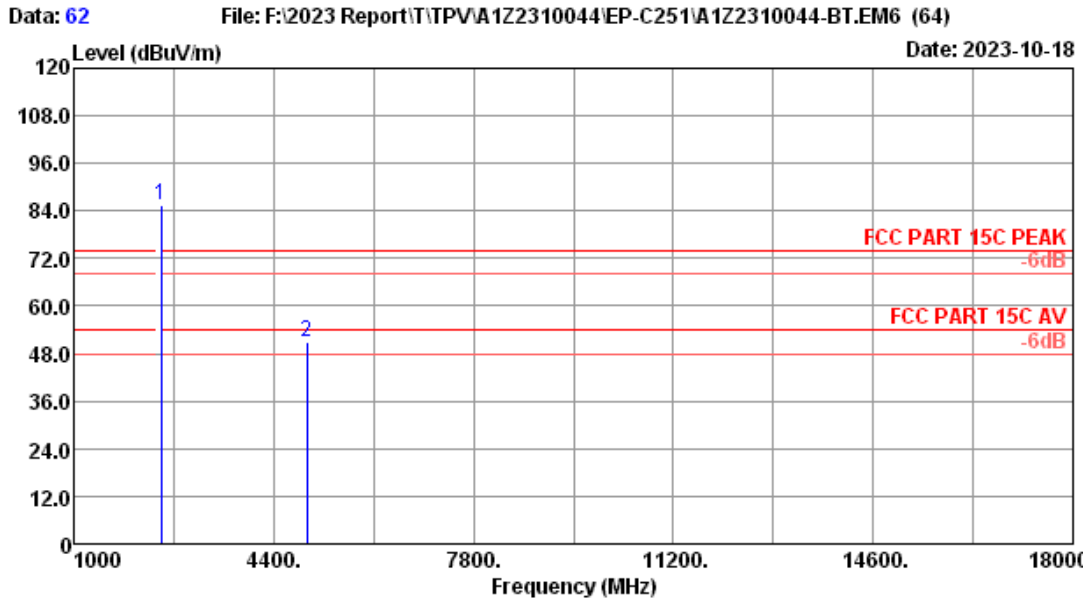
Site no. : 3m Chamber Data no. : 60
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2440MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2440.00	27.76	4.90	86.83	34.36	85.13	-----	-----	Peak
2	4880.00	31.44	6.54	45.57	33.69	49.86	74.00	24.14	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



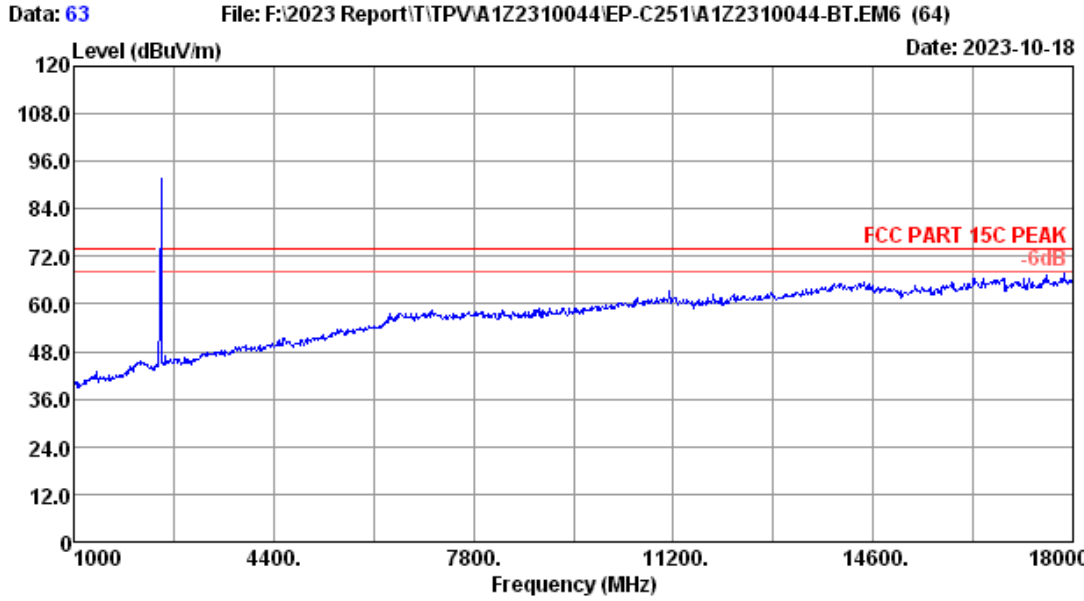
Site no.	: 3m Chamber	Data no.	: 61
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: HORIZONTAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2480MHz TX		



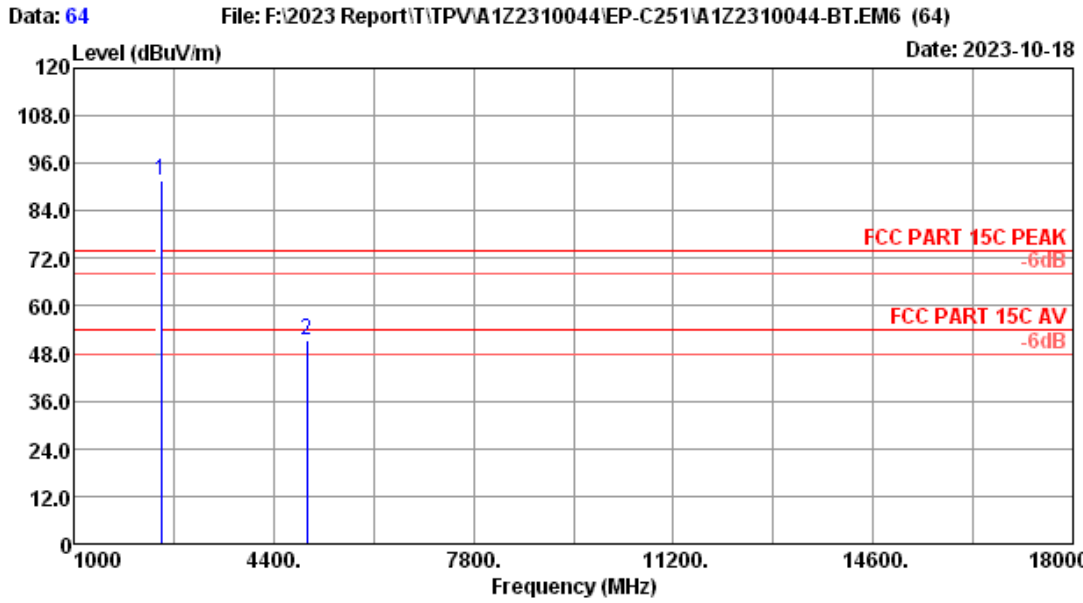
Site no. : 3m Chamber Data no. : 62
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	87.14	34.35	85.52	74.00	23.17	Peak
2	4960.00	31.98	6.58	45.96	33.69	50.83	74.00	23.17	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no.	: 3m Chamber	Data no.	: 63
Dis. / Ant.	: 3m 2023 MCTD1209-3006	Ant. pol.	: VERTICAL
Limit	: FCC PART 15C PEAK		
Env. / Ins.	: 21.0°C/51.1%	Engineer	: nier
Test Mode	: BLE2M 2480MHz TX		



Site no. : 3m Chamber Data no. : 64
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.00	27.80	4.93	93.21	34.35	91.59	74.00	17.59	Peak
2	4960.00	31.98	6.58	46.61	33.69	51.48	74.00	22.52	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

5. CONDUCTED SPURIOUS EMISSIONS

5.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.01,23	1 Year
2.	RF Cable	HUBER+SUHNER	SUCOFLEX-106	505238/6	Apr.02,23	1 Year

5.2. Block Diagram of Test Setup

Please reference to section 2.4.

5.3. Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30dB instead of 20dB.

5.4. Test Procedure

Use the test method described in ANSI C63.10:

The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions With peak detector.

5.5. Test result

PASS (The testing data was attached in the next pages.)

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-11-04	Pressure: 102.3±1.0 kpa	Humidity: 53.6±3.0%
Tested by: Jason	Test site: RF site	Temperature:25.5±0.6 °C

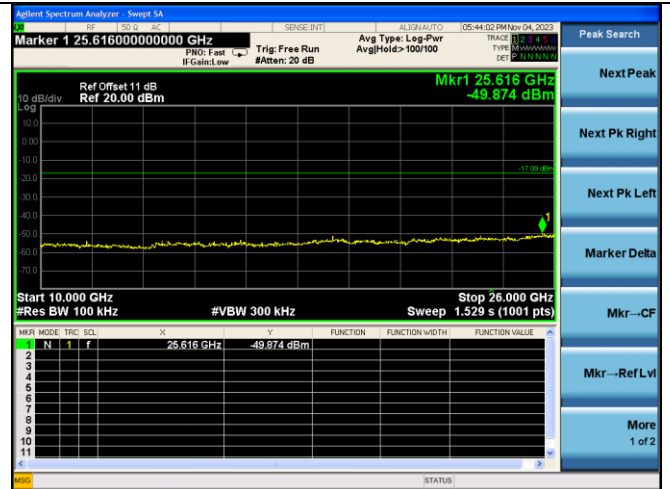
BLE-1Mbps:

GFSK

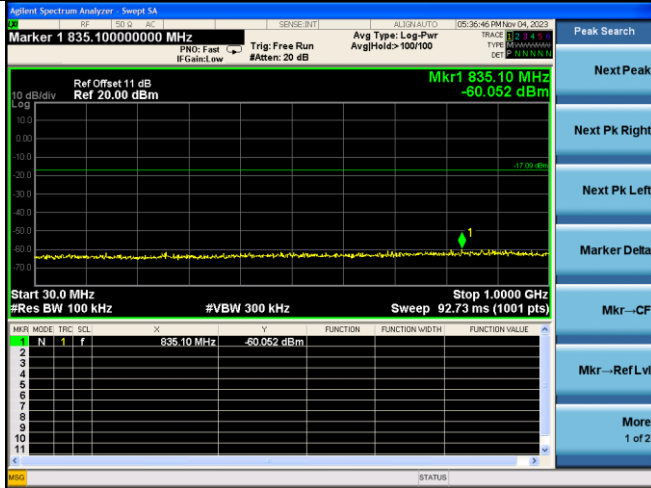
2402MHz



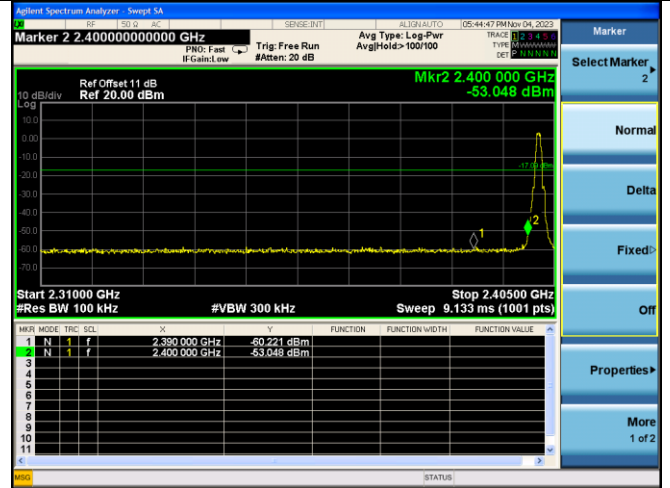
2402MHz(10GHz – 26GHz)



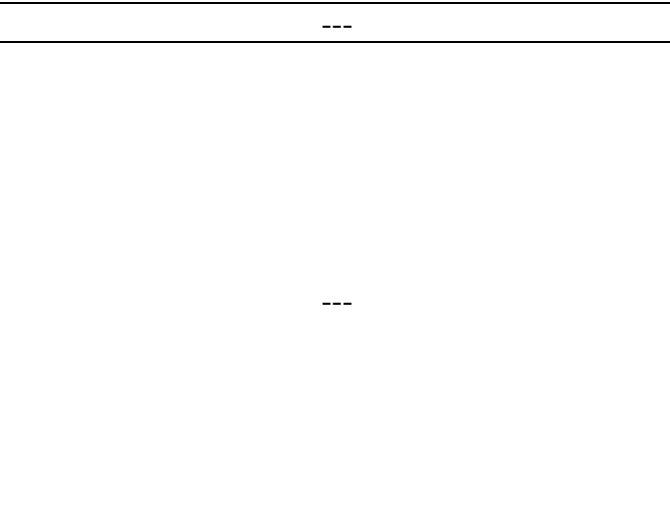
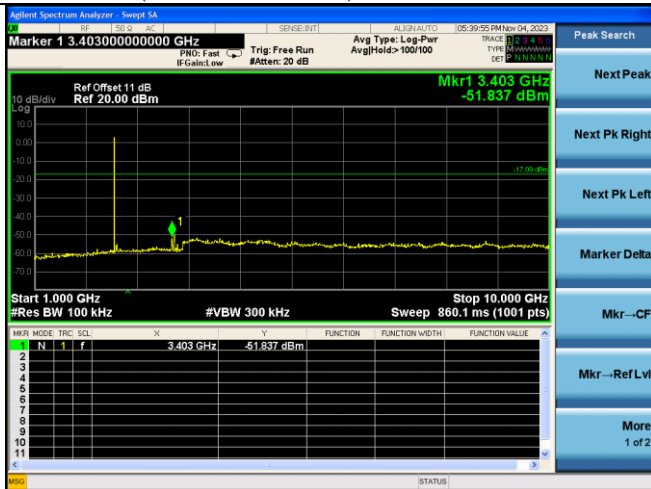
2402MHz(30MHz – 1GHz)



2402MHz(2.3GHz – 2.4GHz)



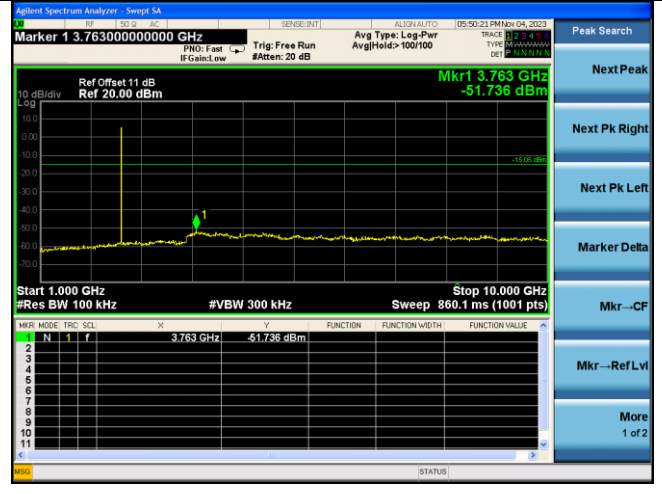
2402MHz(1GHz – 10GHz)



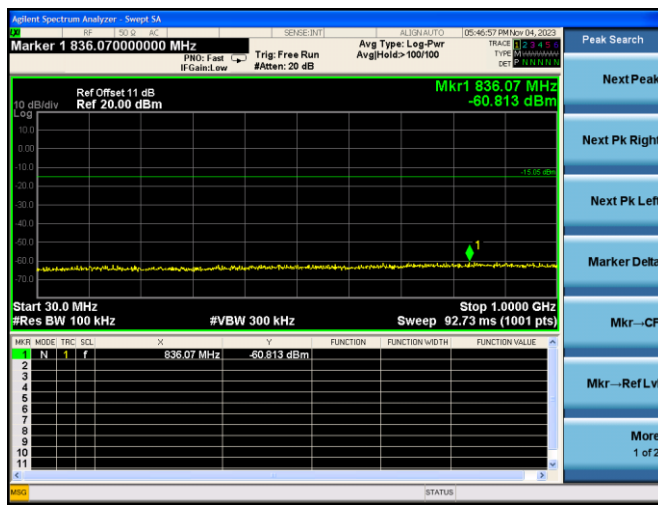
2440MHz



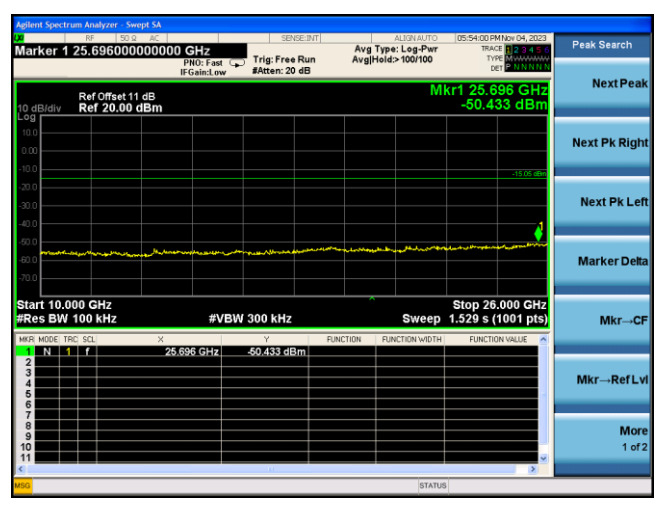
2440MHz(1GHz – 10GHz)



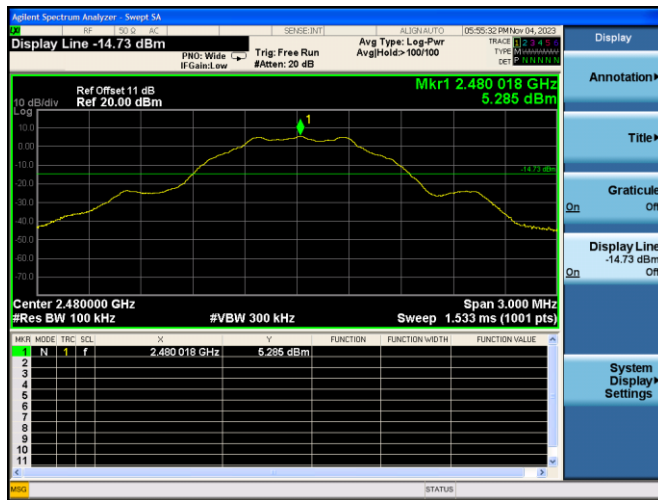
2440MHz(30MHz – 1GHz)



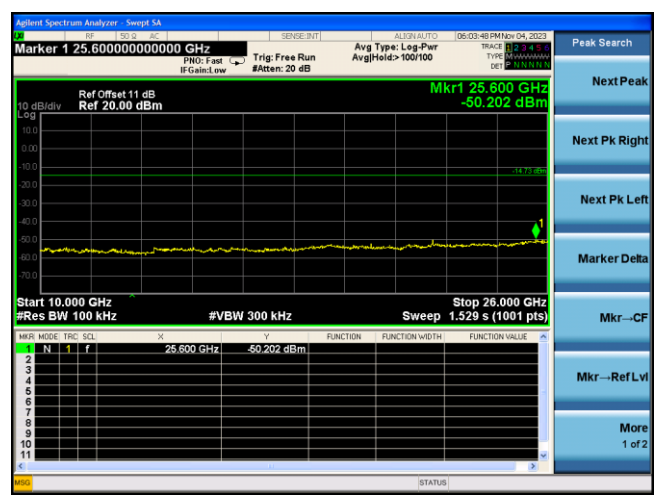
2440MHz(10GHz – 26GHz)



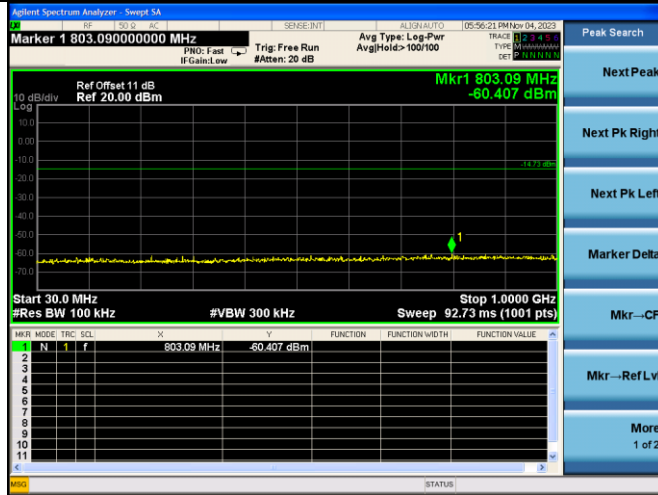
2480MHz



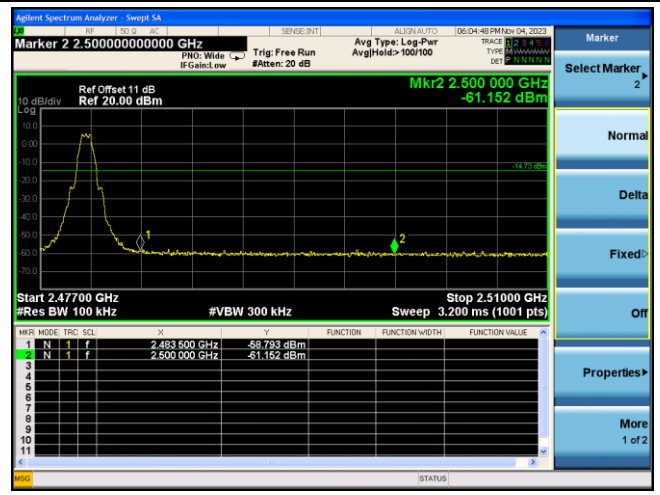
2480MHz(10GHz – 26GHz)



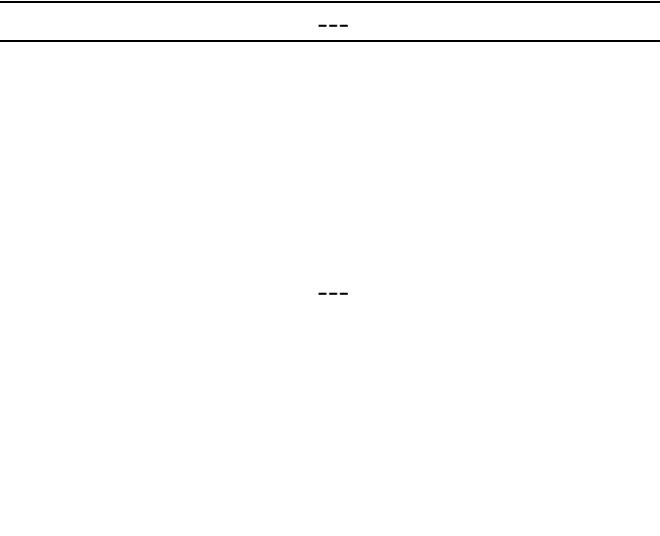
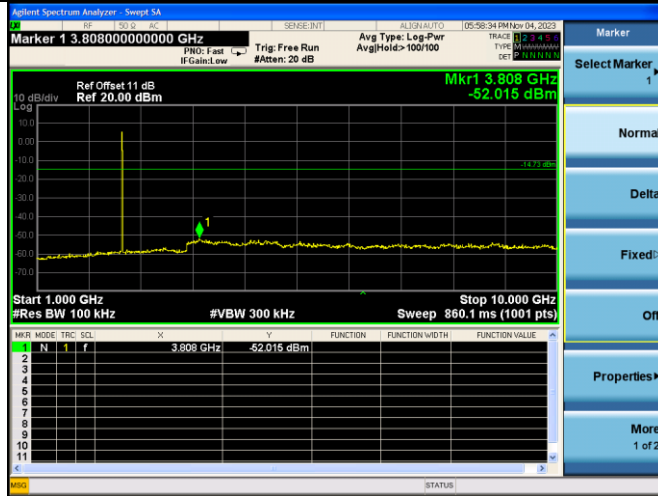
2480MHz(30MHz – 1GHz)



2480MHz(2.4GHz – 2.5GHz)



2480MHz(1GHz – 10GHz)



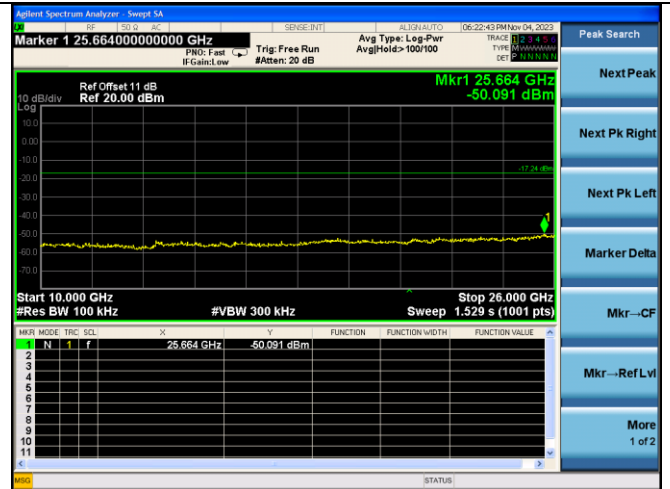
BLE-2Mbps:

GFSK

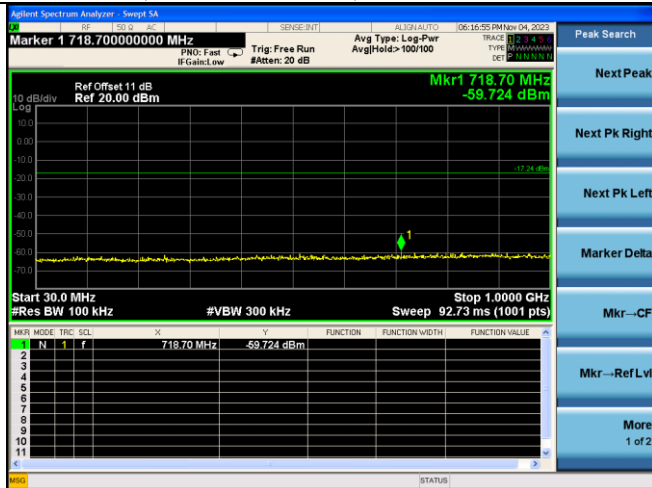
2402MHz



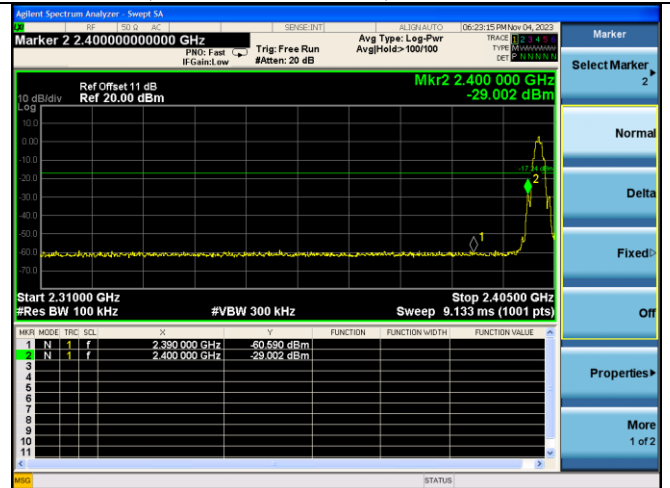
2402MHz(10GHz – 26GHz)



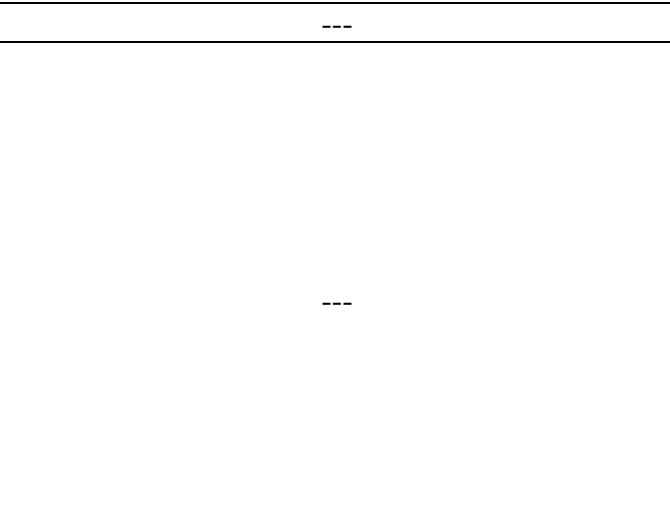
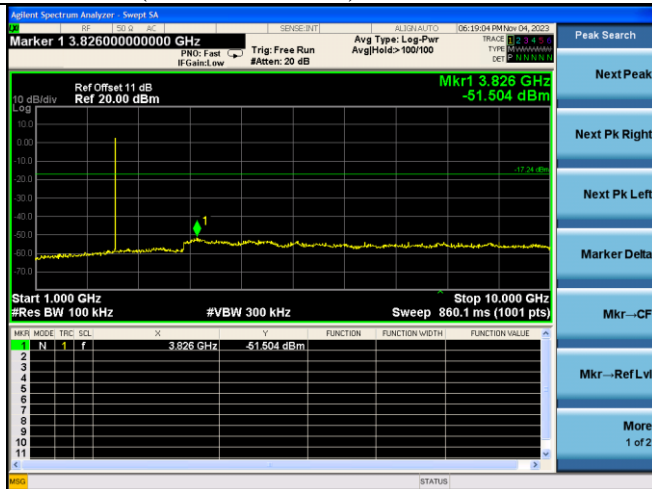
2402MHz(30MHz – 1GHz)



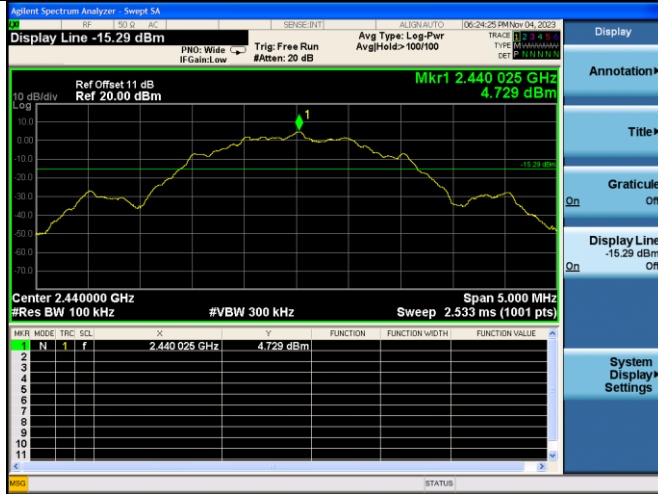
2402MHz(2.3GHz – 2.4GHz)



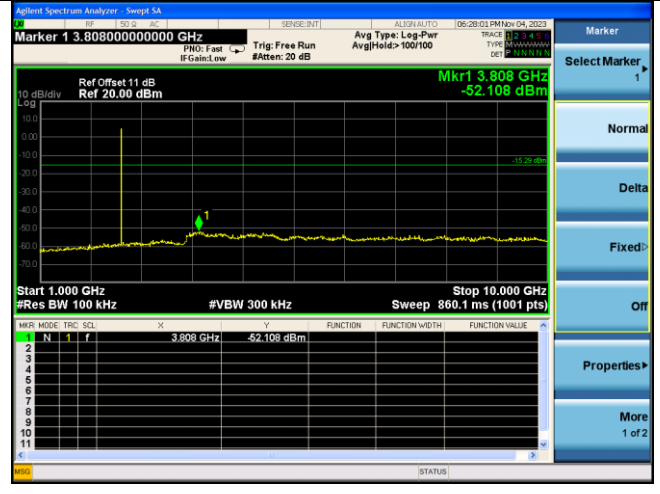
2402MHz(1GHz – 10GHz)



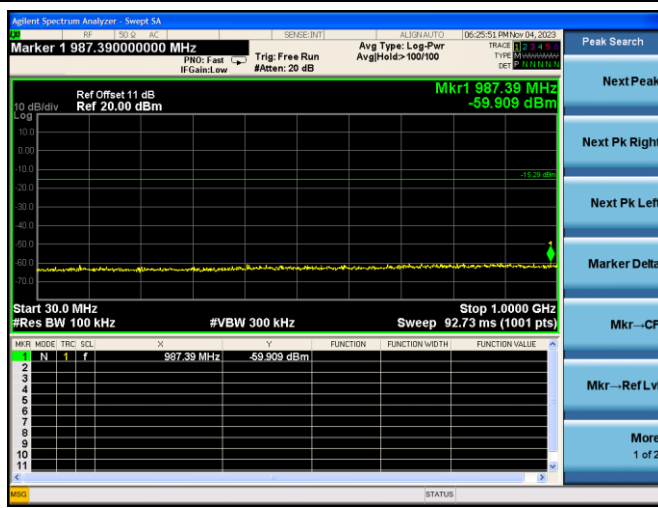
2440MHz



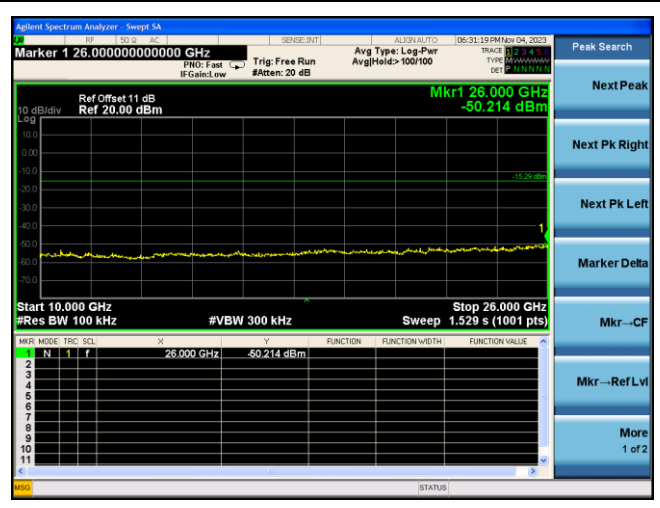
2440MHz(1GHz – 10GHz)



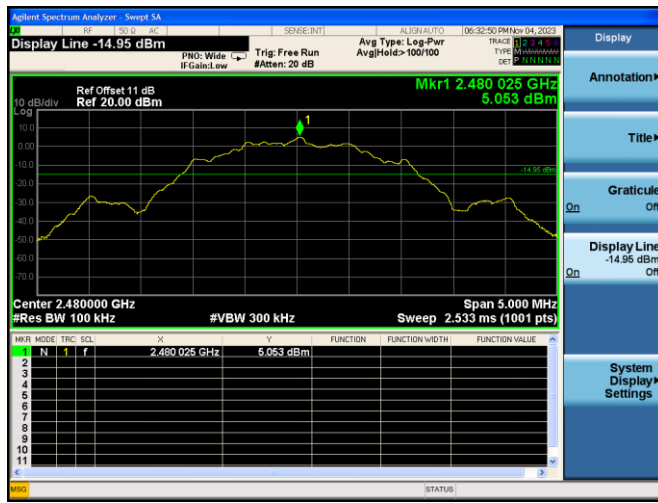
2440MHz(30MHz – 1GHz)



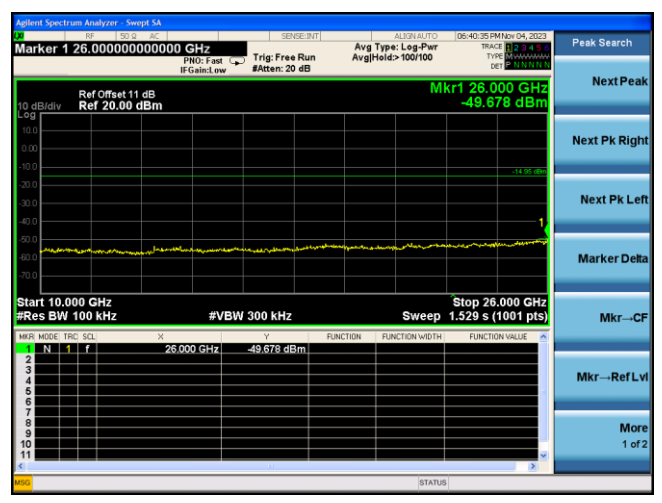
2440MHz(10GHz – 26GHz)



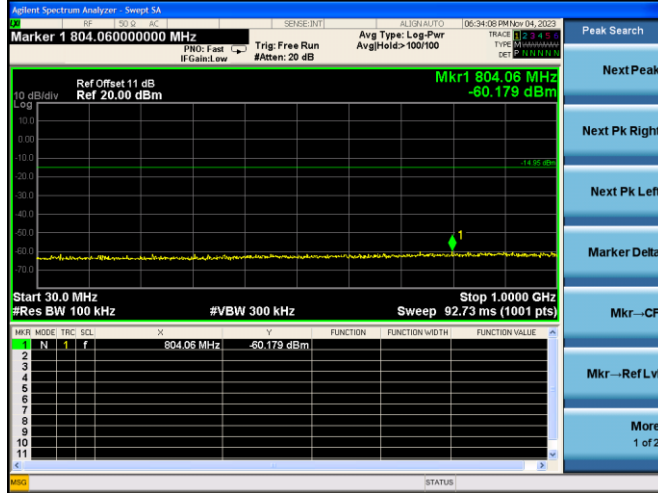
2480MHz



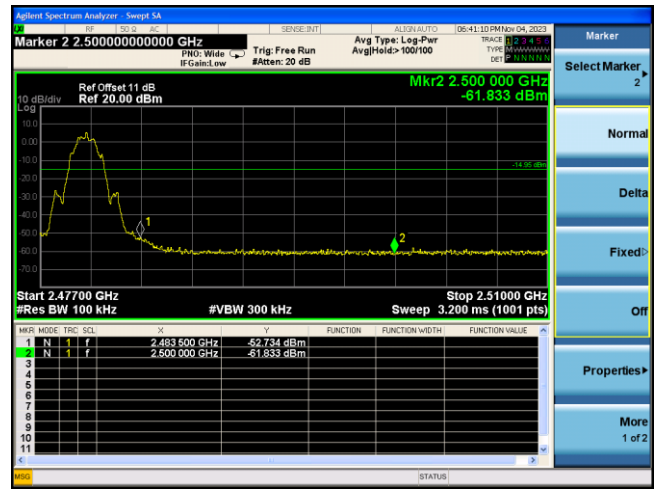
2480MHz(10GHz – 26GHz)



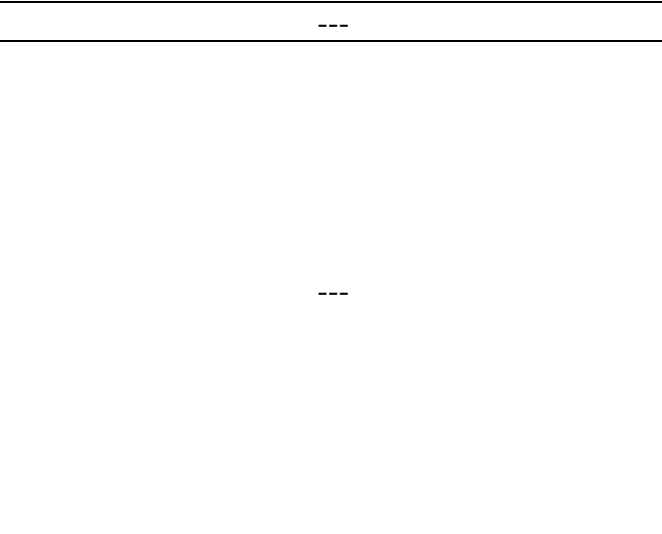
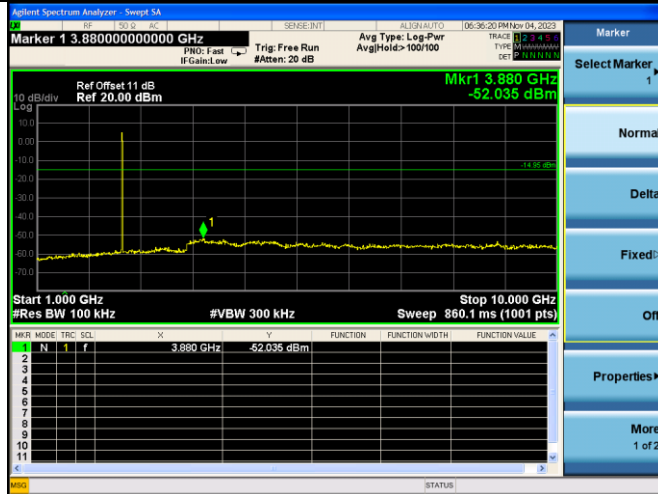
2480MHz(30MHz – 1GHz)



2480MHz(2.4GHz – 2.5GHz)



2480MHz(1GHz – 10GHz)



6. 6DB & 99% BANDWIDTH TEST

6.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.01,23	1 Year
2.	RF Cable	HUBER+SUHNER	SUCOFLE X-106	505238/6	Apr.02,23	1 Year

6.2. Block Diagram of Test Setup

Please reference to section 2.4.

6.3. Limit

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

6.4. Test Procedure

Use the test method described in ANSI C63.10 clause 11.8.2:

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described in 11.8.1 (i.e., $RBW = 100 \text{ kHz}$, $VBW \geq 3 \times RBW$, and peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be $\geq 6 \text{ dB}$.

Use the test method described in ANSI C63.10 clause 6.9.2:

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

- a) The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level. Specific guidance is given in 4.1.5.2.
- d) Step a) through step c) might require iteration to adjust within the specified range.
- e) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- f) Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.

- g) If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- h) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

6.5. Test Results

BLE-1Mbps:

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-10-27	Pressure: 101.3±1.0 kpa	Humidity: 52.4±3.0%
Tested by: Jason	Test site: RF site	Temperature: 23.1±0.6°C

Test Mode	Frequency (MHz)	-6dB Bandwidth (KHz)	Limit (KHz)
GFSK	2402	715.6	≥500
	2440	714.3	≥500
	2480	712.8	≥500

Conclusion: PASS

GFSK	
<p>2402MHz</p> <p>Occupied Bandwidth: 1.0908 MHz Total Power: 10.2 dBm Transmit Freq Error: 12.636 kHz x dB Bandwidth: 715.6 kHz</p>	<p>2440MHz</p> <p>Occupied Bandwidth: 1.0874 MHz Total Power: 11.7 dBm Transmit Freq Error: 17.004 kHz x dB Bandwidth: 714.3 kHz</p>
<p>2480MHz</p> <p>Occupied Bandwidth: 1.0875 MHz Total Power: 12.3 dBm Transmit Freq Error: 20.395 kHz x dB Bandwidth: 712.8 kHz</p>	<p>---</p>

BLE-1Mbps:

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-11-13	Pressure: 101.3±1.0 kpa	Humidity: 52.4±3.0%
Tested by: Jason	Test site: RF site	Temperature: 23.1±0.6°C

Test Mode	CH	99% Bandwidth (KHz)	Limit (MHz)
GFSK	2402	1062.6	N/A
	2440	1065.4	
	2480	1061.0	
Conclusion: Pass			

GFSK	
<p>2402MHz</p> <p>Center Freq: 2.4020000 GHz Occupied Bandwidth: 1.0626 MHz Total Power: 1.60 dBm Transmit Freq Error: 22.244 kHz % of OBW Power: 99.00 % x dB Bandwidth: 1.321 MHz x dB: -26.00 dB</p>	<p>2440MHz</p> <p>Center Freq: 2.4400000 GHz Occupied Bandwidth: 1.0654 MHz Total Power: 3.15 dBm Transmit Freq Error: 24.435 kHz % of OBW Power: 99.00 % x dB Bandwidth: 1.334 MHz x dB: -26.00 dB</p>
<p>2480MHz</p> <p>Center Freq: 2.4800000 GHz Occupied Bandwidth: 1.0610 MHz Total Power: 3.75 dBm Transmit Freq Error: 30.665 kHz % of OBW Power: 99.00 % x dB Bandwidth: 1.300 MHz x dB: -26.00 dB</p>	<p>---</p> <p>---</p>

BLE-2Mbps:

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-10-27	Pressure: 101.3±1.0 kpa	Humidity: 52.4±3.0%
Tested by: Jason	Test site: RF site	Temperature: 23.1±0.6°C

Test Mode	Frequency (MHz)	-6dB Bandwidth (KHz)	Limit (KHz)
GFSK	2402	1084	≥500
	2440	1107	≥500
	2480	1108	≥500
Conclusion : PASS			

GFSK	
2402MHz	2440MHz
<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.40200000 GHz</p> <p>Center Freq 2.40200000 GHz</p> <p>Occupied Bandwidth 2.0939 MHz</p> <p>Total Power 10.0 dBm</p>	<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.44000000 GHz</p> <p>Center Freq 2.44000000 GHz</p> <p>Occupied Bandwidth 2.0964 MHz</p> <p>Total Power 12.1 dBm</p>
<p>Agilent Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.48000000 GHz</p> <p>Center Freq 2.48000000 GHz</p> <p>Occupied Bandwidth 2.0950 MHz</p> <p>Total Power 12.7 dBm</p>	---

BLE-2Mbps:

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-11-13	Pressure: 101.3±1.0 kpa	Humidity: 52.4±3.0%
Tested by: Jason	Test site: RF site	Temperature: 23.1±0.6°C

Test Mode	CH	99% Bandwidth (KHz)	Limit (MHz)
GFSK	2402	2070.1	N/A
	2440	2070.5	
	2480	2074.9	

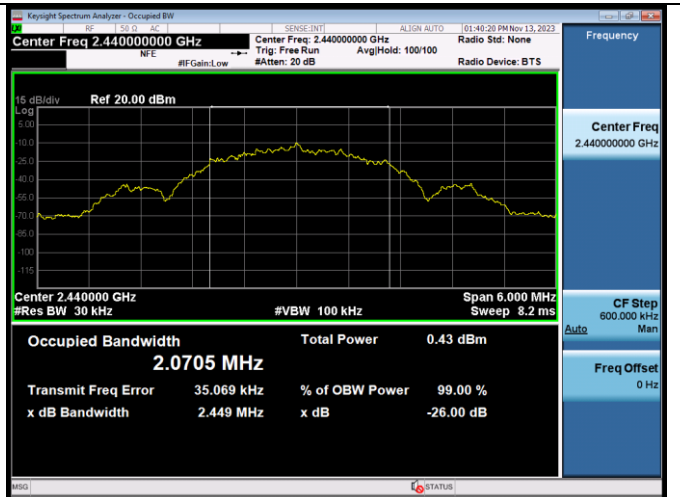
Conclusion: Pass

GFSK

2402MHz



2440MHz



2480MHz



7. MAXIMUM PEAK OUTPUT POWER TEST

7.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.01,23	1 Year
2.	Power meter	Anritsu	ML2487A	6K00002472	Jun.26,23	1 Year
3.	Power sensor	Anritsu	MA2491A	032516	Jun.26,23	1 Year
4.	RF Cable	HUBER+SUHNER	SUCOFLE X-106	505238/6	Apr.02,23	1 Year

7.2. Limit

For systems using digital modulation in the 2400—2483.5MHz, The Peak out put Power shall not exceed 1W(30dBm).

7.3. Test Procedure

Use the test method descried in ANSI C63.10 clause 11.9.1.3:

For Peak output power: Connected the EUT's Antenna port to PXA signal analyzer;

For Average power: Connected the EUT's Antenna port to Power sensor and power meter;

7.4. Test Results

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-10-26	Pressure: 102.3±2.0 kpa	Humidity: 53.6±3.0%
Tested by: Jason	Test site: RF site	Temperature: 25.5±0.6℃

BLE-1Mbps:

Test Mode	Frequency (MHz)	Power Setting	Peak output Power (dBm)	Limit (dBm)
GFSK	2402	Default	3.687	30
	2440	Default	5.223	30
	2480	Default	6.486	30
Conclusion: PASS				

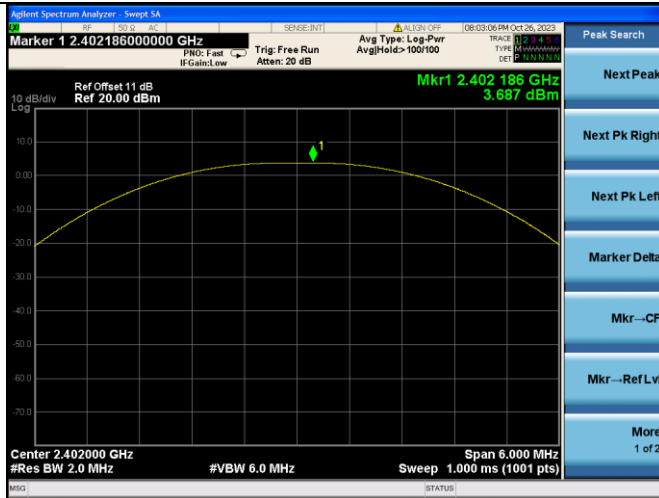
BLE-2Mbps:

Test Mode	Frequency (MHz)	Power Setting	Peak output Power (dBm)	Limit (dBm)
GFSK	2402	Default	3.688	30
	2440	Default	5.241	30
	2480	Default	6.500	30
Conclusion: PASS				

BLE-1Mbps:

GFSK

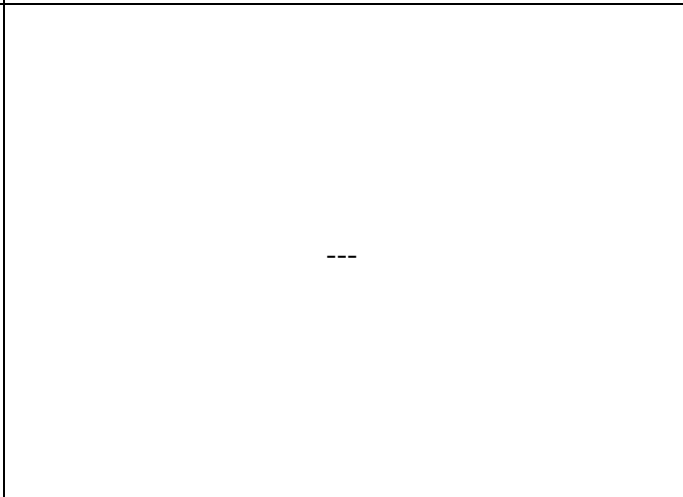
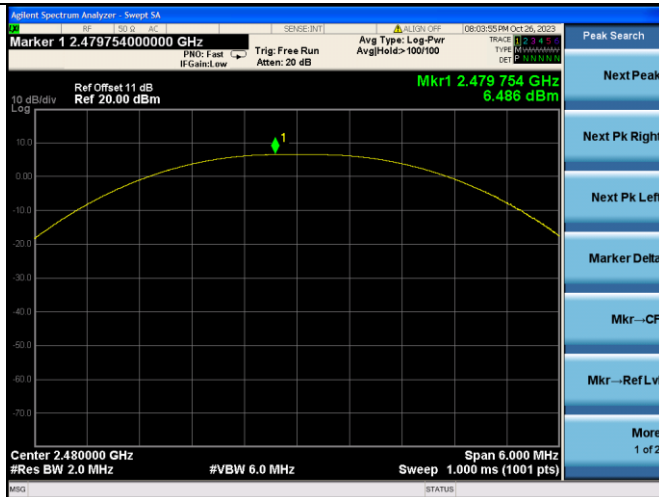
2402MHz



2440MHz



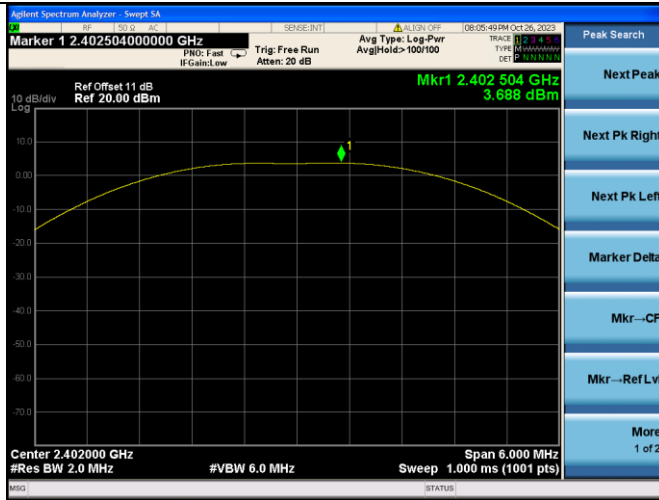
2480MHz



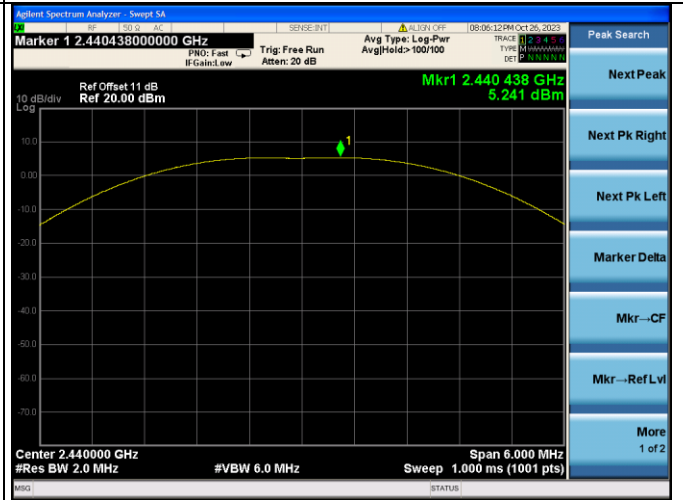
BLE-2Mbps:

GFSK

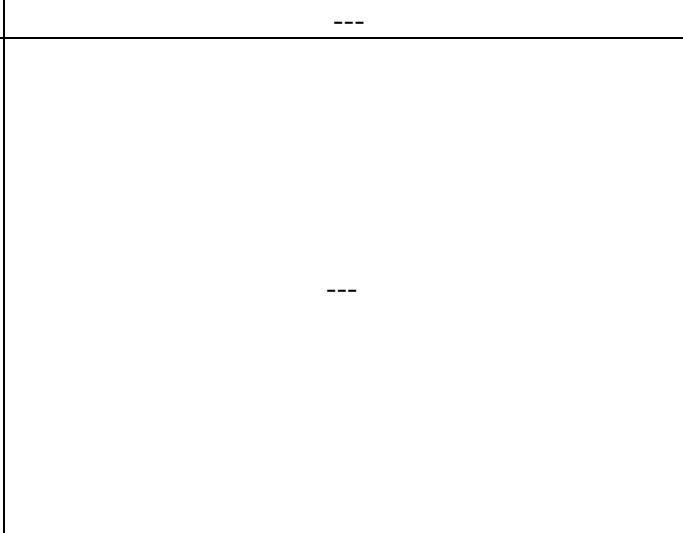
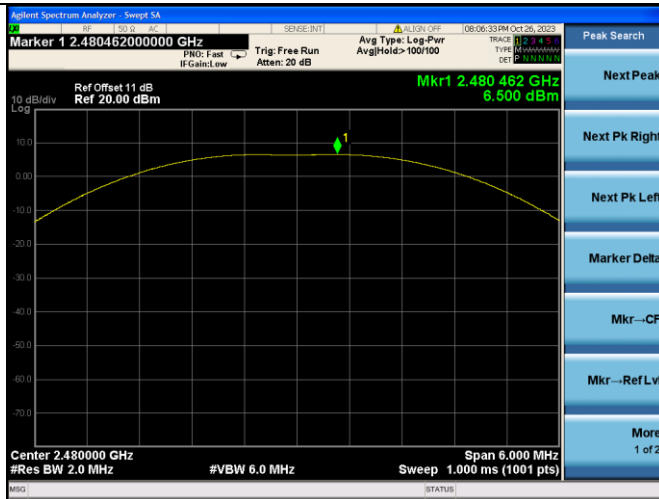
2402MHz



2440MHz



2480MHz



8. BAND EDGE COMPLIANCE TEST

8.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	3mChamber(Svswr)	AUDIX	N/A	N/A	Aug.09,22	3Year
2.	3mChamber(SE)	AUDIX	N/A	N/A	Sep.16,22	3Year
3.	Signal Analyzer	Rohde & Schwarz	FSV30	104050	Apr.01,23	1 Year
4.	Amplifier	EMCI	EMC0518A45SE	980965	Aug.25,23	1 Year
5.	RF Cable	Shanghaichaoyu	SFT205-NMSM-10.00M	689241	Aug.25,23	1 Year
6.	Test Software	AUDIX	e3	6.100913a	N/A	N/A
7.	Horn Antenna	ETC	MCTD 1209	DRH15F03006	Aug.23,23	1 Year

Note: N/A means Not applicable.

8.2. Limit

All the lower and upper band-edges emissions appearing within 2310MHz to 2390MHz and 2483.5MHz to 2500MHz restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions outside operation frequency band 2400MHz to 2483.5MHz shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

8.3. Test Produce

Use the test method described in ANSI C63.10 clause 6.10:

For upper band emissions that are up to two bandwidths(2MHz) away (2483.5MHz to 2485.5MHz) from the band-edge use below produce:

1. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 100KHz and with a video bandwidth 300KHz. Record the peak levels of the fundamental emission and the relevant band-edge emission, Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.
2. Subtract the delta measured in step (1) from the maximum field strengths measured in clause 4 .The resultant field strengths are then used to determine band-edge compliance as required by Section 15.205

For emissions above two bandwidths away from the band-edge use below produce:

1. The EUT is placed on a turntable, which is 0.8m above the ground plane and worked at highest radiated power.
2. The turntable was rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.

4. Set the spectrum analyzer in the following setting in order to capture the lower and upperband-edges of the emission:

(a) PEAK: RBW=1MHz ;VBW=3MHz, PK detector, Sweep=AUTO

(b) This is pulse Modulation device a duty cycle factor was used to calculate average level based measured peak level.

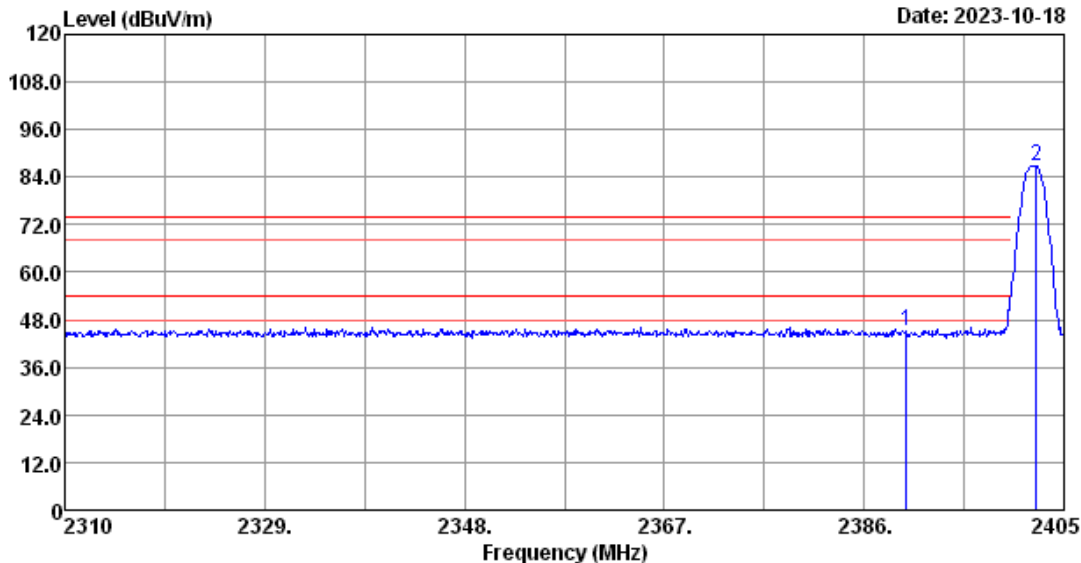
8.4. Test Results

Pass (The testing data was attached in the next pages.)

Note: If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

BLE-1Mbps:

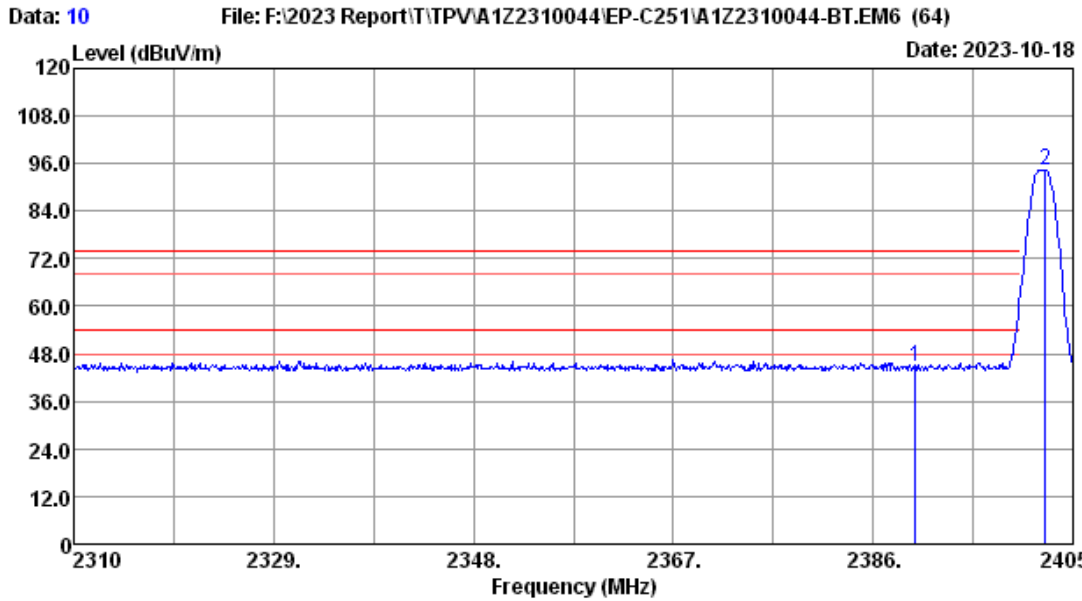
Data: 9 File: F:\2023 Report\T\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



Site no. : 3m Chamber Data no. : 9
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.62	4.85	46.96	34.36	45.07	74.00	28.93	Peak
2	2402.34	27.61	4.86	88.66	34.36	86.77	-----	-----	Peak

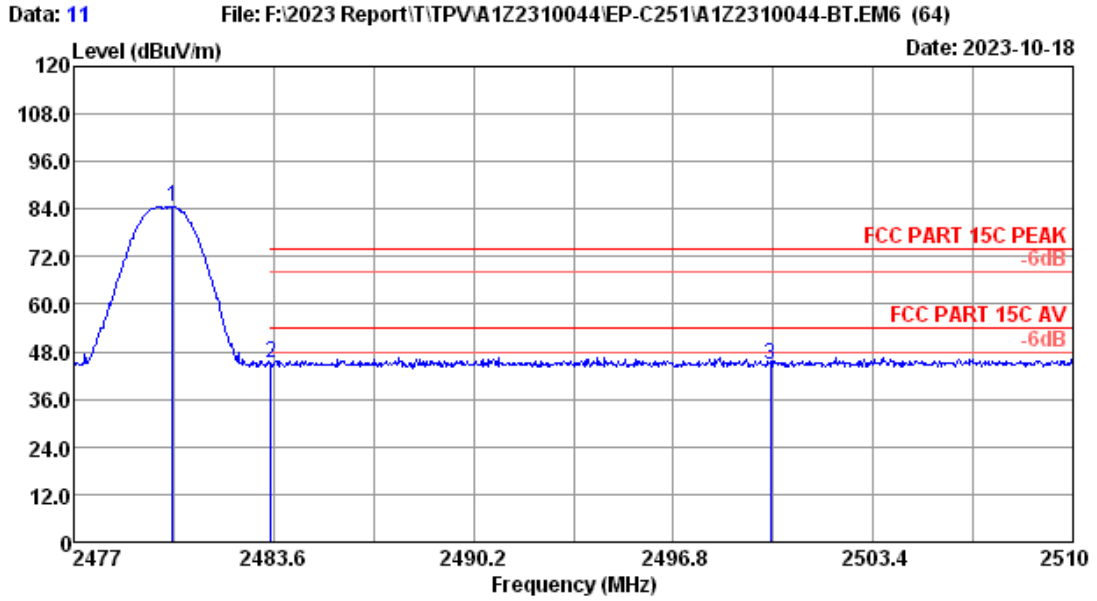
Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 10
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.62	4.85	46.62	34.36	44.73	74.00	29.27	Peak
2	2402.34	27.61	4.86	96.36	34.36	94.47	-----	-----	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

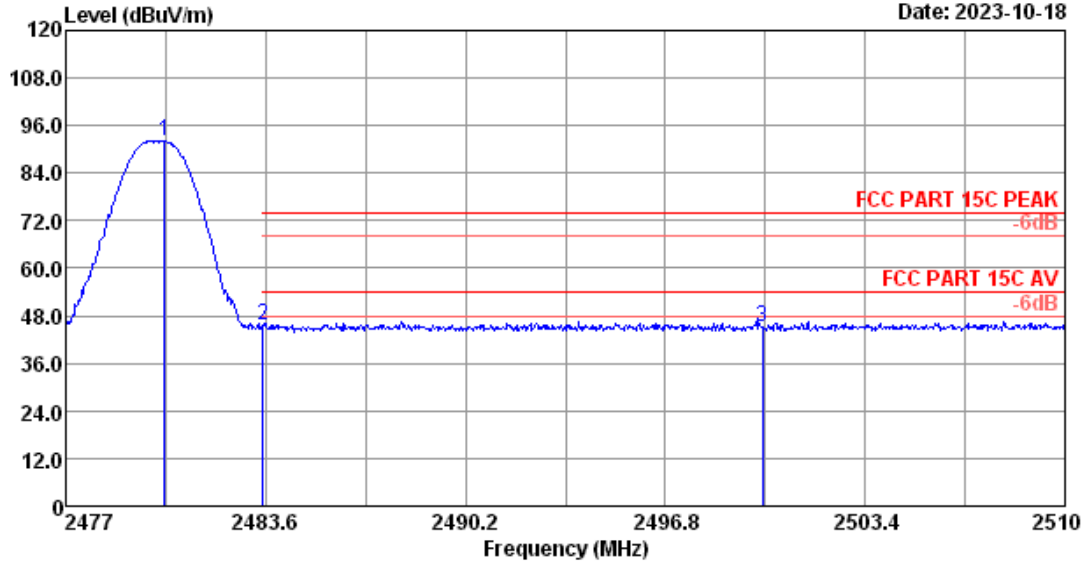


Site no. : 3m Chamber Data no. : 11
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.27	27.80	4.93	86.09	34.35	84.47	-----	-----	Peak
2	2483.50	27.80	4.94	46.99	34.35	45.38	74.00	28.62	Peak
3	2500.00	27.80	4.95	46.18	34.35	44.58	74.00	29.42	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

Data: 12 File: F:\2023 Report\T\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



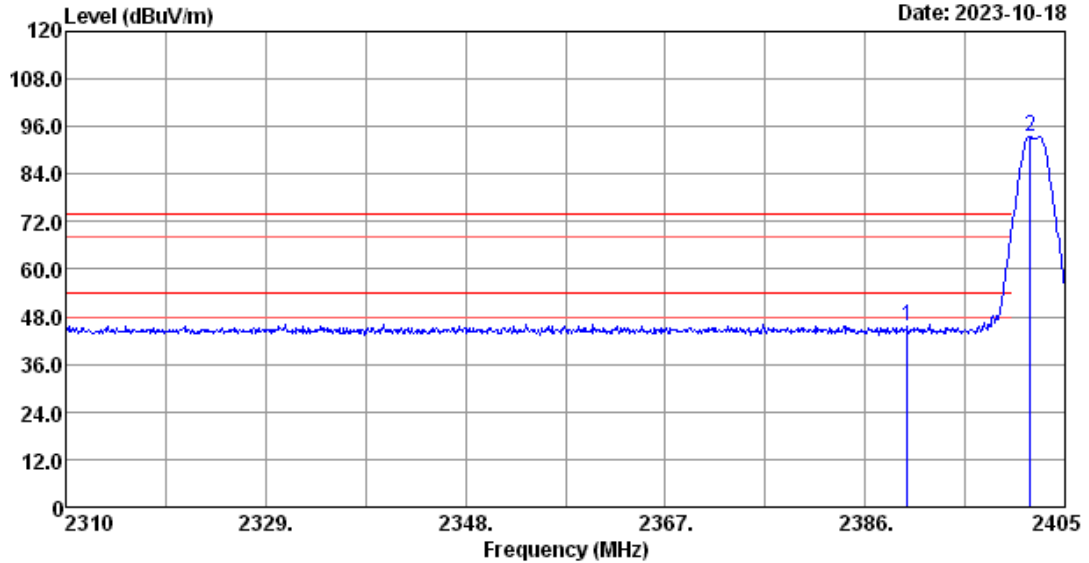
Site no. : 3m Chamber Data no. : 12
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE1M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.27	27.80	4.93	93.59	34.35	91.97	-----	-----	Peak
2	2483.50	27.80	4.94	47.02	34.35	45.41	74.00	28.59	Peak
3	2500.00	27.80	4.95	46.90	34.35	45.30	74.00	28.70	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

BLE-2Mbps:

Data: 13 File: F:\2023 Report\T\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18

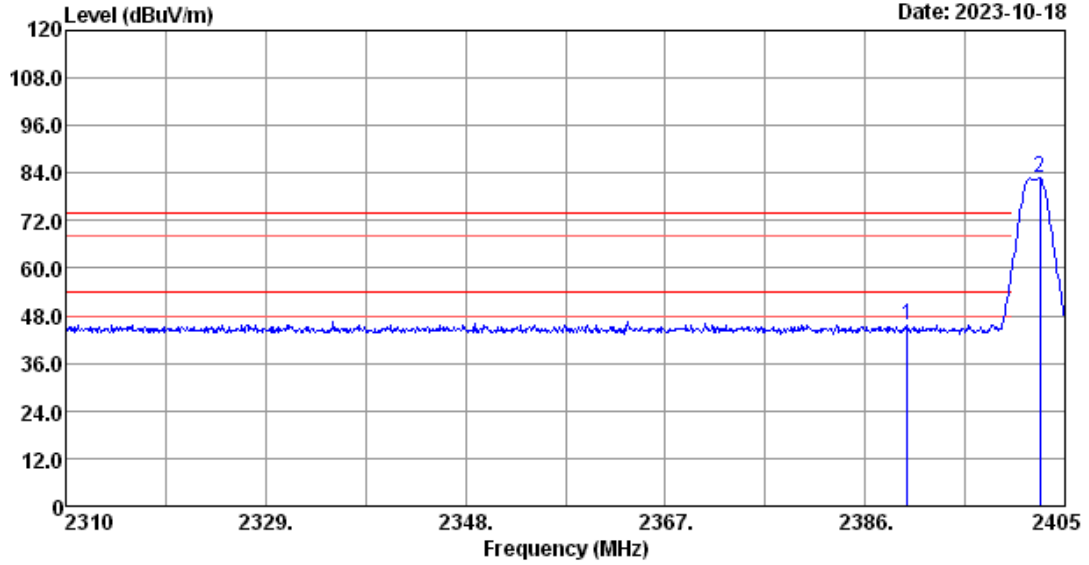


Site no. : 3m Chamber Data no. : 13
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.62	4.85	47.30	34.36	45.41	74.00	28.59	Peak
2	2401.68	27.61	4.86	95.34	34.36	93.45	-----	-----	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

Data: 14 File: F:\2023 Report\T\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18

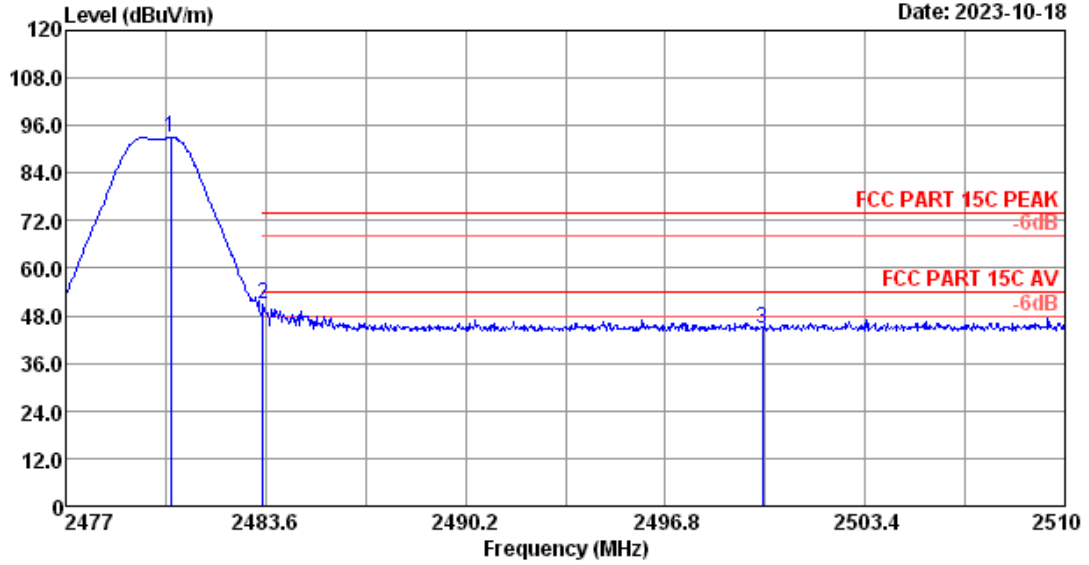


Site no. : 3m Chamber Data no. : 14
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2402MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2390.00	27.62	4.85	47.58	34.36	45.69	74.00	28.31	Peak
2	2402.63	27.61	4.86	84.54	34.36	82.65	-----	-----	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading - Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

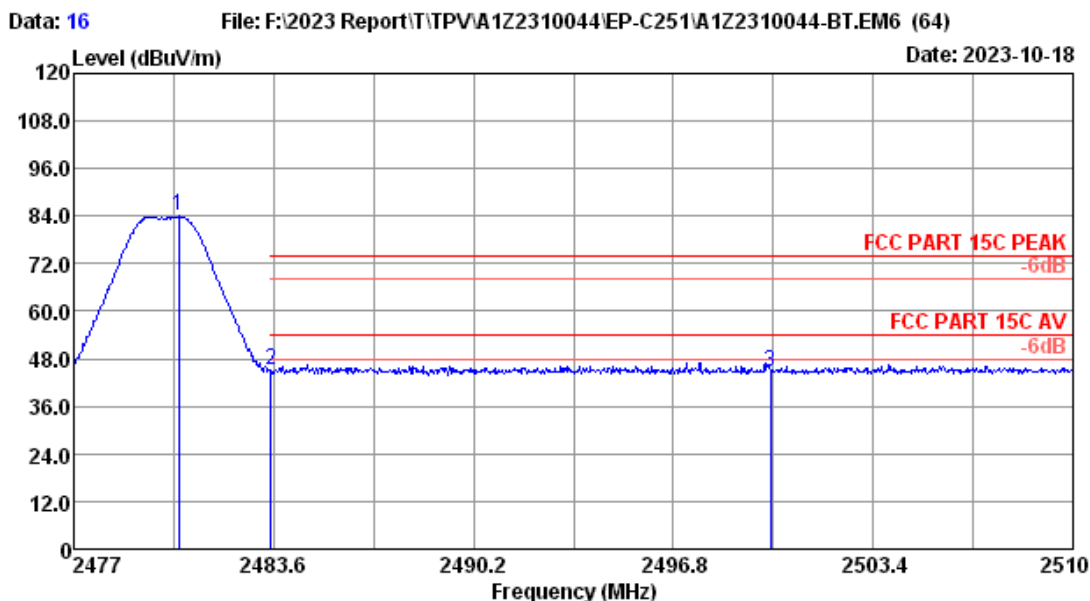
Data: 15 File: F:\2023 Report\T\TPV\A1Z2310044\EP-C251\A1Z2310044-BT.EM6 (64) Date: 2023-10-18



Site no. : 3m Chamber Data no. : 15
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : VERTICAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.47	27.80	4.93	94.62	34.35	93.00	-----	-----	Peak
2	2483.50	27.80	4.94	52.31	34.35	50.70	74.00	23.30	Peak
3	2500.00	27.80	4.95	46.30	34.35	44.70	74.00	29.30	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 3m Chamber Data no. : 16
 Dis. / Ant. : 3m 2023 MCTD1209-3006 Ant. pol. : HORIZONTAL
 Limit : FCC PART 15C PEAK
 Env. / Ins. : 21.0°C/51.1% Engineer : nier
 Test Mode : BLE2M 2480MHz TX

No.	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Amp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	2480.47	27.80	4.93	85.54	34.35	83.92	-----	-----	Peak
2	2483.50	27.80	4.94	46.76	34.35	45.15	74.00	28.85	Peak
3	2500.00	27.80	4.95	46.53	34.35	44.93	74.00	29.07	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss + Reading -Amp factor.
 2. The emission levels that are 20dB below the official limit are not reported.

9. POWER SPECTRAL DENSITY TEST

9.1. Test Equipments

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	PXA Signal Analyzer	Agilent	N9030A	MY51380221	Apr.01,23	1 Year
2.	RF Cable	HUBER+SUHNER	SUCOFLEX-106	505238/6	Apr.02,23	1 Year

9.2. Block Diagram of Test Setup

Please reference to section 2.4.

9.3. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

9.4. Test Procedure

Use the test method described in ANSI C63.10 clause 11.10.2:

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d) Set the VBW $\geq [3 \times \text{RBW}]$.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

9.5. Test Results

EUT: Electronic paper display		
M/N: EP-C251		
Test date: 2023-11-03	Pressure: 102.1±1.0 kpa	Humidity: 51.1±3.0%
Tested by: Jason	Test site: RF site	Temperature: 22.8±0.6°C

BLE-1Mbps:

Test Mode	Frequency (MHz)	Power density (dBm/3KHz)	Limit (dBm/3KHz)
GFSK	2402	-10.367	8
	2440	-8.591	8
	2480	-8.152	8
Conclusion: PASS			

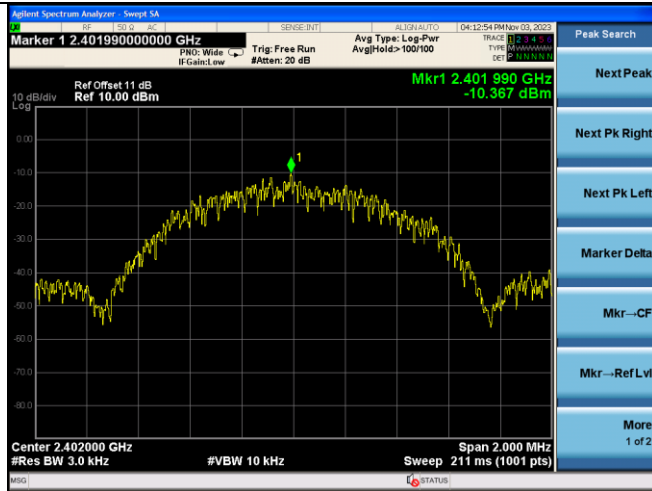
BLE-2Mbps:

Test Mode	Frequency (MHz)	Power density (dBm/3KHz)	Limit (dBm/3KHz)
GFSK	2402	-13.059	8
	2440	-11.198	8
	2480	-10.842	8
Conclusion: PASS			

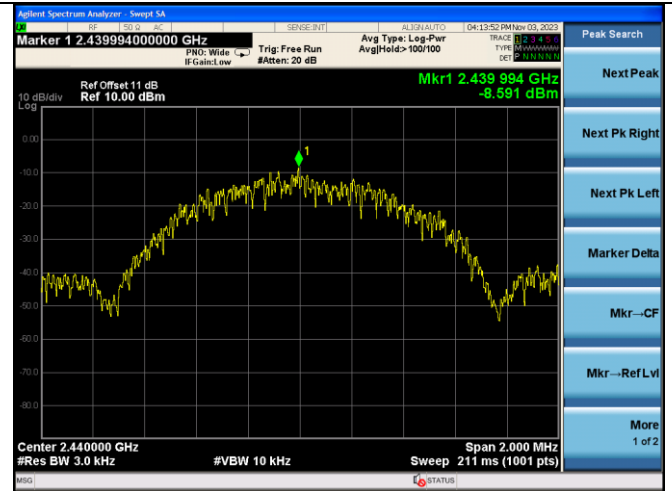
BLE-1Mbps:

GFSK

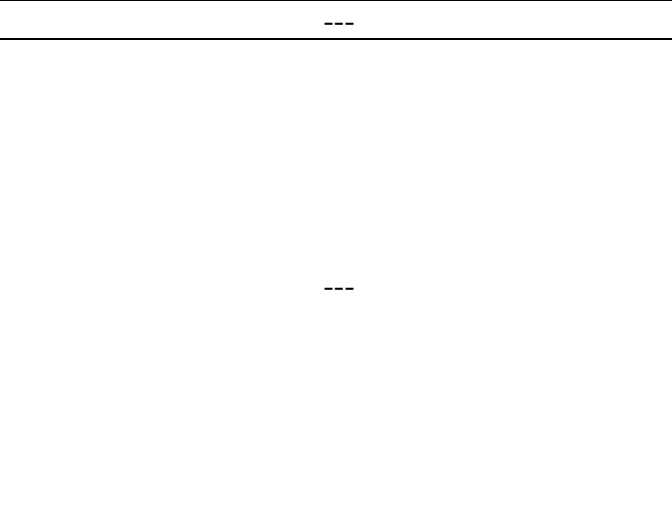
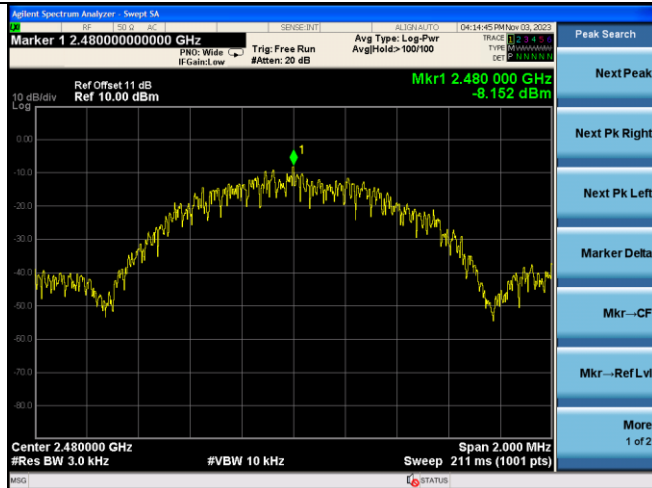
2402MHz



2440MHz



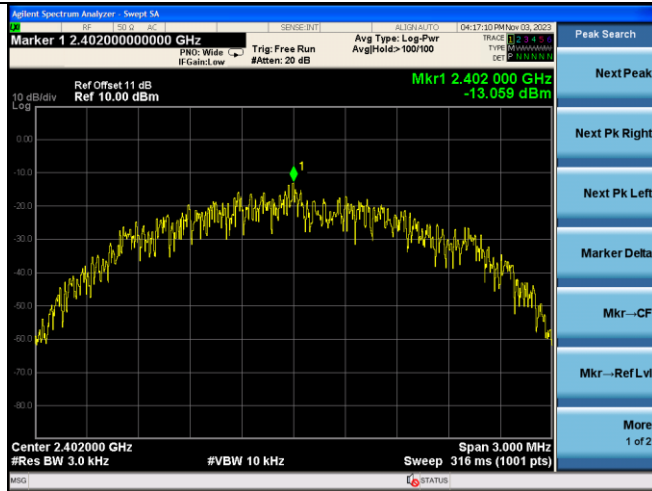
2480MHz



BLE-2Mbps:

GFSK

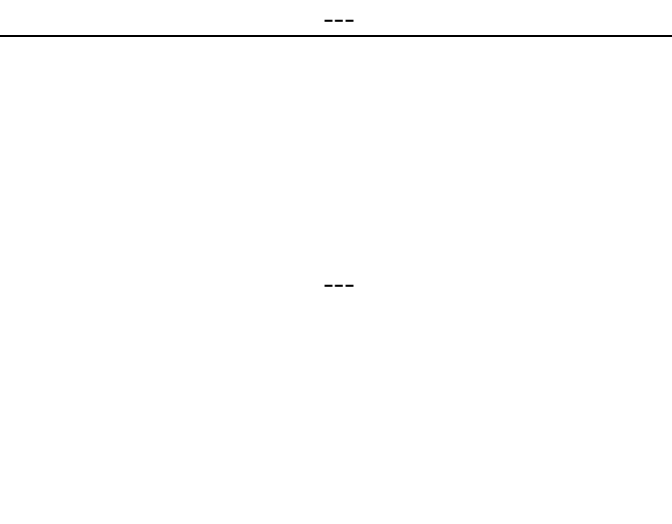
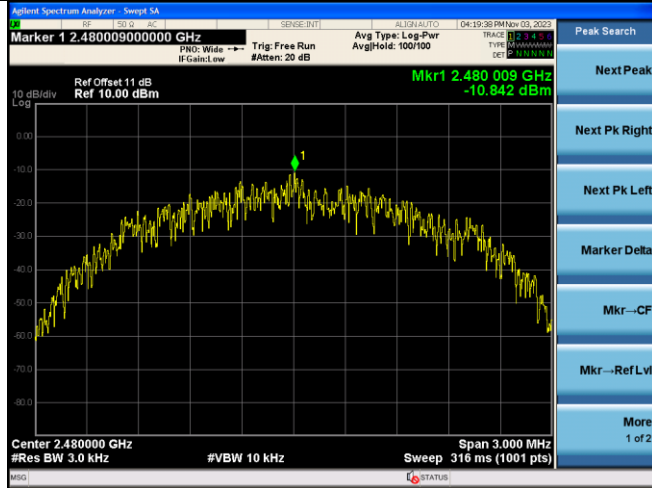
2402MHz



2440MHz



2480MHz



10. ANTENNA REQUIREMENT

10.1. STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

10.2. ANTENNA CONNECTED CONSTRUCTION

The antennas used for this product is shrapnel Antenna that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 2.69dBi.

11. DEVIATION TO TEST SPECIFICATIONS

[NONE]

..... **THE END**